European Commission

JRC SCIENCE FOR POLICY REPORT

# RIO COUNTRY REPORT 2015: Slovak Republic

Vladimir Balaz
Jana Zifciakova

*2016*

EUR 27860 EN

Joint Research Centre

**Contact information**
Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)
E-mail: jrc-ipts-secretariat@ec.europa.eu
Tel.: +34 954488318
Fax: +34 954488300

**JRC Science Hub**
https://ec.europa.eu/jrc

JRC101220

EUR 27860 EN

PDF ISBN 978-92-79-57795-6 ISSN 1831-9424 doi:10.2791/751866 LF-NA-27860-EN-N



How to cite:, Vladimir Balaz, Jana Zifciakova; RIO Country Report 2015: Slovak Republic;
EUR 27860 EN; doi:10.2791/751866



**Abstract**
The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

# Table of Contents

## Foreword

The report offers an analysis of the R&I system in the Slovak Republic for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Slovak research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The quantitative data is, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in February 2016. The report contents are partly based on the RIO country report, 2014 (Balaz, 2015a).

## Acknowledgments

The report has benefited from the comments and suggestions of Diana Demková and Ľubica Pitlová from the Department for National and European Science and Technology Policy of the Ministry of Education, Science, Research and Sport of the Slovak Republic, as well as of Zuzana Nehajová and Juraj Hošťák from the DG for Innovation and Business Environment of the Ministry of Economy of the Slovak Republic. The comments from DG RTD and from JRC IPTS (Katarzyna Szkuta and Mathieu Doussineau) are also gratefully acknowledged.

Peter Fako, Lorenzo Isella and Athina Karvounaraki produced the statistics and the analytical assessments for sections 3.2 and 3.6 of the report.

We would like to thank Martine Troonen and Sophie Bodart for their assistance in preparing this report for publication.

Authors' affiliation:

Vladimir Balaz, Slovak Academy of Sciences (Bratislava, Slovak Republic)

Jana Zifciakova, European Commission, Directorate-General Joint Research Centre, Directorate J - Institute for Prospective Technological Studies, Innovation Systems Analysis unit (Brussels, Belgium)

# Executive summary

**Context**

The Slovak gross expenditure on research and development (GERD) was €669.6m (0.89% of GDP) in 2014 (2013: €610.9 and 0.83% GDP). The 2014 National Reform Programme for the Slovak Republic set 2020 targets for GERD and the business expenditure on research and development (BERD) to 1.2% and 0.8% respectively. These targets are rather modest, but they seem realistic. There were some significant increases in business research spending since 2008 (albeit from a lower base).

The Slovak Republic performed rather modestly in most publication indicators compared to the EU28 average. This may have been triggered by insufficient funding and mechanisms for funding allocation. There is also little connection between the results of evaluation exercises and the allocation of institutional funding. However, the Accreditation Commission has implemented several noteworthy initiatives aimed at increasing excellence in science. Despite the considerable efforts that have been made over the past few years, the Slovak research policies still lack a clear focus on the joint research agendas addressing grand challenges and joint programming. The amount of national funding appears to be still insufficient to integrate the Slovak science properly in European and international co-operation networks.

The Slovak Government adopted the 'Concept paper for the support of start-ups and the development of the start-up ecosystem in the Slovak Republic' on 10 June 2015 which intends to react on the current status and existing challenges, take a comprehensive and coordinated approach on the topic and avoid fragmented or ad-hoc activities. This may be potentially a promising initiative since the support to the creation and early development phase of innovative enterprises has not been articulated before in the Slovak research and innovation policies. So far, the Slovak law does not recognise 'start-up' and/or 'spin-off' entities and the 'small and medium-sized enterprise' (SME) are acknowledged by the Slovak law, but their definition is not included in Slovak law.

In July 2015, the Slovak Republic adopted a programme to support the return of Slovak professionals from abroad. Even though the results are not significant yet, it is a noteworthy initiative which may also support the return of Slovak scientists home.

The Slovak Republic is progressing well in building clusters and implementing clustering policies. The European Commission performed a European-wide benchmarking of the cluster organisations. The benchmarking indicated that the quality of some Slovak clusters is comparable to the quality of some clusters in advanced OECD members. The IT Valley cluster in the Košice region was the first cluster in the Central Eastern Europe to obtain a Golden Certificate of European Excellence.

Key recent developments include:

- ✓ The new law on Income Tax which includes new tax reliefs for R&D entered into force in January 2015.
- ✓ The Slovak government approved in June 2015 the Concept Paper for supporting start-ups proposed by the Ministry of Finance. Its aim is to strengthen the business environment and create conditions to encourage the start-ups ecosystem.
- ✓ The Slovak Government renamed the Agency for the Structural Funds of the European Union (ASFEU) to the Research Agency (RA). The agency should create conditions for the participation of Slovak research teams in the ERA in general, and in the ESFRI, EITI, technology platforms and Horizon 2020 in particular.

The identified challenges for the Slovak R&I systems are to:

(1) Improve the R&I governance;
(2) Improve the quality of the science base;
(3) Increase private innovation outputs and R&D investments;
(4) Strengthen synergies between science and industry.

**R&I Challenges**

Challenge 1: **Improve the R&I governance**

Description

The Slovak Republic fares modestly in the international comparison of public governance quality and effectiveness of public administration with a high turnover of civil servants due to government changes and underdeveloped analytical capacities (OECD 2013). It has also a fragmented R&I policy governance and there are limited synergies between the ministries and the eight government agencies support R&D and innovation. This may lead to a lack of coordination and dispersion of limited financial resources.

The institutional finance for R&I is provided by the Slovak Government, yet the Slovak Republic finances most of its R&I policy from EU Structural Funds. This may raise questions about the long-term sustainability of this funding model.[1] The majority of the Structural Funds in 2007-2013 were invested in building research, applied and industry research was also supported from Structural Funds, albeit on a smaller scale.

There are no regional R&I policies as the degree of regional institutional autonomy is low. All the regions built their Regional Innovation Strategies by 2015, however their impact is limited, since it is not mandatory for the central government to consider the targets and the objectives set in regional planning documents.

The institutional and project finance for research is channelled via agencies of the central government (VEGA, KEGA, SBA, SIEA, SRDA, Research Agency). No regional policy measures are envisaged in the operational programmes (except for allocations to the Bratislava Region). The fragmented and sub-efficient RD&I support system may partly explain the low participation of domestic enterprises in R&D activities.

Policy response

The introduction of the Slovak Government Council for Research, Development and Innovations (SGCSTI) in 2013 provided a high-level structure bringing together main ministries responsible for R&I policy and the main research performer – the Slovak Academy of Sciences (SAS). The SGCSTI prepared a set of strategic documents, namely the newly adopted Research and Innovation Strategy for Smart Specialisation (RIS3) of the Slovak Republic (2013-2014) that paves the way for a more focused and centralised governance and announces several important reforms, e.g. the creation of a GCSTI Standing Committee for the RIS3 strategy.

The National Reform Programme (NRP) 2015[2] foresees significant changes, including the merger of numerous funding agencies into the Agency of Research and the Agency of Technology, as well as the transforming of the Slovak Academy of Sciences (SAS) institutes, budgetary and subordinate organisations into public research institutes (PRI). The initial draft of the NRP envisaged nine PRI, but the Slovak Government did not approve the Law on the PRI by May 2016 and, thus, this concept was not implemented.[3]

The National Reform Programme (NRP) 2016[4] foresees that after the adoption of the RIS3, the implementation of individual measures will begin with the aim of establishing structural changes in science and research. The measures will be mainly focused on the targeted use and the stabilisation of public funds and support for the engagement of private sector in R&D activities. Financing will be focused on increasing the quality of research, promoting the infrastructure built from EU funds and connecting universities, science academies, research institutions and partners from the industry sector.

---

[1] This refers to project funding only, the institutional funding is provided by the Slovak Government.

[2] http://www.finance.gov.sk/en/Default.aspx?CatID=450.

[3] The transformation of the SAS was foreseen in a law proposal by the MESRS, which was rejected by the government at the end of May 2015 mainly because of significant disagreements about the ownership of buildings and land.

[4] http://www.finance.gov.sk/en/Default.aspx?CatID=450.

Assessment

The adoption of the Action Plan to implement the RIS3 strategy is still pending and the merger of the funding agencies was announced last year, but it is not implemented yet.[5]

There were no functional regional systems of innovation governance by end of 2015 in the Slovak Republic and there was no progress in building a regional system of innovation governance. There were no major changes in the layout of competences in R&I policies between the central and regional governments.

The RIS3 announced important reforms such as the reform of the higher education, reform of the Slovak Academy of Sciences and the reform of the secondary education (dual education aimed at vocational training). Up to now, the government started only the reform of the secondary education, whereas the other reforms were delayed.

Challenge 2: **Improve the quality of the science base**

Description

The Slovak Republic ranks among the more modest research performers in the EU, demonstrated by indicators such as the percentage of the top 10% most highly cited publications for the period 2000-2013 (5.73% compared with 7.34% in the Czech Republic and 13.1% in Germany) and the total number of patent applications by the Patent Cooperation Treaty (48 compared to 168 in the Czech Republic and 17.577 in Germany). The Research Excellence Composite Indicator places the Slovak Republic markedly behind the leading EU Members States in terms of research excellence; however, the country's performance has improved notably since 2007.

Public-private partnerships have had a limited role in leveraging additional funding. The funding allocation is mostly channelled to non-oriented research and general university funds through institutional funding. The Slovak Republic has one of the lowest rates of public spending on higher education in the EU.

Monitoring mechanisms in place, based on output indicators and international benchmarking try to evaluate the performance of public research organisations, higher education institutions and research programmes and projects, but they do not assess funding efficiency. The funding of the R&I system is not focused on specific themes and economic sectors. The country is not sufficiently attractive for foreign researchers. Only 579 foreign nationals worked in the public sector in 2014, i.e. 2.7% of the total. Relatively low wages, low quality research infrastructures and a language barrier may explain the low inward researchers' mobility rates.

Policy response

The Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (RIS3) and the National Reform Programmes (NRP) 2014, 2015 and 2016 set as goals to raise the quality of research, promote the use of the infrastructure built from EU funds, connect research institutions and industrial partners and commercialise scientific results.

[5] The Slovak Government approved the final version of The Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (RIS3) via the Government Resolution no. 665/2013 on 13 November 2013. The RIS3 document will be implemented by two Action Plans for Research and Innovation (for 2015-2016 and for 2017-2020). In 2015 the Ministry of Education, Science, Research and Sport of the Slovak Republic (MESRS) drafted three versions of the Action Plan for the RIS3 document for the period 2015-2016, however its adoption is still pending. The Slovak Government has rejected the first two versions of the Action Plan. The major difficulties related to the reform of R&I governance. The final draft of the Action Plan was approved by the Slovak Government Council for the Science, Technology and Innovation (SGCSTI) on 4 September 2015 and sent out to the European Commission for further comments. This draft concentrated on legislative measures aimed at the reform of funding agencies, the transformation of the SAS, the reform of higher and secondary education, the introduction of new system of the R&I policy support measures, the introduction of evaluation framework for the RIS3 and the preparation of the national ESFRI Roadmap. These measures may stimulate business R&D expenditure and applied research, as well as increase science excellence.

The NRP 2014 discloses that expenditure from the state budget will be raised mainly in education, R&D and transport infrastructure. However, the plans formulated in policy documents have not been enforced yet. In June 2015 the government agreed on an increased budget for the Slovak Academy of Sciences (SAS) for the following three years.

The Slovak Government's Phoenix Strategy seeks to improve researcher mobility, encourage collaborative projects, attract foreign researchers and return migration. Mobility centres, the National Scholarship Programme and the EC EURAXESS portals offer access to global researcher networks. In addition, the Slovak Republic's Research and Development Agency (SDRA) supports various international co-operation projects.

Assessment

The performance of the research system in the Slovak Republic is slowed down by the lack of consistent long-term planning and of a financing model that stimulates excellence and best practice in research management. This may be improved by creating a human resources strategy for public research organisations with a transparent selection of people and with regular assessments performed by peers and external evaluators. The effects and the progress of mobility policy measures may be monitored and reviewed more closely.

The Ministry of Education, Science, Research and Sports (MESRS) and the Accreditation Commission have implemented several initiatives aimed at increasing excellence in the Slovak science. The MESRS has closed one private HEI and has abolished two study programmes in another HEI. The Accreditation Commission has stopped a high number of study programmes. However, a comprehensive reform of the evaluation criteria for the HEIs is still missing.

Challenge 3: **Increase private innovation outputs and R&D investments**

Description

One of the most important barriers to develop a strong private R&D sector and promote innovation is the dual economy[6]. In the Slovak Republic multinational companies (MNCs) have high productivity, but lack in-house research activities. In spite of its past FDI competitive advantage and production process sophistication, the country has not been very successful in increasing employment in R&D activities and in sectors related to exports of knowledge-intensive services. Thanks to MNCs the country has an increasing share of high-tech exports (consumer electronics) compared with its neighbours and a high share of medium high-tech export (automotive), but there is only a very low number of Slovak SMEs innovating in-house and those that do innovate do not collaborate with others. (Innovation Union Scoreboard 2015)

Policy response

Measures to support innovation-oriented enterprises and the emergence of start-ups were adopted recently. A law introducing additional tax deductions for private companies investing in R&D entered into force in January 2015. The new tax deductions permit companies investing in R&D to reduce their tax bases with an additional 25% of their R&D expenditure, 25% of their wage for R&D employees and 25 % of the yearly R&D expenditures increase. A Concept paper for supporting start-ups was adopted in June 2015. The concept identifies the strategic objectives for the support of start-ups in the Slovak Republic: creating favourable conditions for entrepreneurship (a regulatory environment without unnecessary obstacles to the creation and operation of start-ups on the market), establishing and providing support services to strengthen the start-up

[6] Dual economy (Boeke, 1953) refers to an economy in which rich, capital-intensive modern sectors exist in the same model as comparatively poor, traditional, labour intensive sectors. Please see - J.H. Boeke (1953) Economics and Economic Policy of Dual Societies, New York: Institute of Pacific Relations.

ecosystem and financing the so-called 'valley of the death' phase of business initiatives (the point where most start-ups fail).

The Slovak Republic participates in the JEREMIE initiative, which provides risk capital to support innovations in SMEs. The 2014-2020 Operational Programme Research and Innovation (OPRI) envisages grants and other (revolving) schemes to support start-ups in the knowledge-intensive sectors, business advice and networking, cluster schemes and small business innovation research projects. The OPRI will support 13,000 enterprises and 1,400 start-ups.

Several forms of state aid for foreign investors are in place: discounted prices for land, financial subsidies for acquiring assets, tax credits and grants for the creation of new jobs. According to the Act on Investment Aid (2007) investors can obtain assistance for investment or expansion projects of technology centres. The Act is designed to encourage investments into high value-added products and research and development or into less-developed regions with high unemployment.

Assessment

It is still early to assess the measures related to tax incentives and start-ups. However, facilitating the access to funds by simplifying administrative rules may be indispensable. The new law on Income Tax stipulates that, in order to obtain the new tax deduction and reduce 25% of their social security and health insurance payments for R&D employees, companies investing in R&D should hire employees that are younger than 26 years and no longer than 2 years after graduation. Only a few young R&D employees can match these criteria, except maybe IT specialists.

The complexity and the administrative burden associated with the JEREMIE initiative often discourage SMEs to apply for it. Even if the OPRI was adopted already in November 2014, its Action Plan has not been approved yet. It is still uncertain whether the state aid regime now in place is enough attractive for investors to perform in-house research.

Challenge 4: **Strengthen synergies between science and industry**

Description

A recurring theme in the Country Reports issued in the framework of the European Semester and the subject of CSRs in 2013 and 2014, is the need to address the weak cooperation between science and business. The total research spending (GERD) allocated through business-funded–publicly-performed R&D was 5.1% of GERD in 2011, 1.5% higher than the EU-28 average of 3.6%. Yet, the average percentage of academia-industry co-publications between 2003 and 2013 is 0.9%, far below the EU-28 average of 2.2%. In 2013 the Slovak Republic had 6.8 public-private co-publications per million of population compared with 29 for the EU-28 (17.5 for Czech Republic, 12.8 for Hungary). (Innovation Union Scoreboard 2015)

Data on labour markets and human resources show that foreign MNCs and local SMEs active in low-medium tech industries are not recruiting highly skilled R&D personnel. The latest available data (Eurostat, 2012) show that the Slovak Republic has a low level of PhD holders that find work in the private sector (1.24% in 2012). In 2012, only 17% of researchers were employed in business and only 0.19% of the active workforce was employed in R&D.

The recent evaluations point to several reasons for the low level of synergies between science and industry. The low absorption capacity from the demand side may result from a large number of SMEs with limited innovation capacities and the preference for technology import both in the case of multinationals and domestic companies. The low interest from the supply side may be due to insufficient incentives for researchers involved in knowledge transfer activities, little support for business creation and development of spin-off companies, a rather limited familiarity of R&D institutions with the business sector cooperation possibilities and a weak performance in patenting and licencing.

Policy response

Policy makers acknowledged the need to improve the framework conditions for knowledge transfer in the 2014-2020 RIS3 and towards the end of the 2007-2013 operational programmes. The Annex to the 2014 NRP lists a number of relevant policy initiatives in the reform of science and technology, such as "support for building technology transfer centres". The 2007-2013 operational programmes implemented two national projects promoting knowledge transfer, which allocated €530.5m to businesses until December 2014. The Ministry of Education, Science, Research and Sports (MESRS) addressed the issue of low engagement of researchers with business while preparing the framework for the evaluation of the RIS3.

Assessment

It is too early to assess the policy measures introduced in 2013-2014, however they focused mostly on building the R&I infrastructure and less on building networks and supporting collaboration. Upgrading the infrastructure in certain technological domains as well as building clusters and implementing cluster policies policy may enhance cooperation between academia and industry and knowledge and technology transfer.

The approval of the Action Plan to implement the Operational Programme Research and Innovation (OPRI) and the Action Plan to implement the RIS3 are still pending. Their endorsement is essential for the implementation and the financing of measures aimed at research results commercialisation and the fostering of science-academia collaboration.

The 'Concept paper on the support to start-ups and development of the start-up eco-system' is an important step in building new tools to increase science-business cooperation. Yet, at present, the concept has only a strategic character and a follow-up with concrete policy measures and action plans may ensure its timely implementation.

# 1. Overview of the R&I system

## 1.1 Introduction

The Slovak Republic has area of 49,034 square kilometres and population of 5.4 million. It accounts for 1.11% of area and 1.06% of population of the EU28. The Eurostat data indicate that the Slovak per capita nominal gross domestic product (GDP) was €14,400, about one half of the EU average in 2015[7]. The Slovak GDP (in total and also by per capita) grew by, 2.5% in 2014 and 3.6% in 2015. The Eurostat estimated growth in Slovak GDP for 3.2% in 2016. The unemployment rate was 13.2% in 2014, but dropped to 11.5% in 2015 (Table 1). The budget deficit increased from 2.7% in 2014 to 3.0% in 2015. The share of the government debt in GDP peaked with 55.0% in 2013, but dropped to 52.9% in 2015. The improved economic outlook and the decrease in the unemployment rate helped public finance recovery. The Slovak Government approved the Government Resolution no 307/2015 on the 'Concept paper for the support of start-ups and the development of the start-up ecosystem in the Slovak Republic' on 10 June 2015. The policy measures aimed at start-ups are planned for 2016. The Slovak Academy of Sciences (SAS), the Ministry of Science, Research and Sports (MESRS) and the Ministry of Finance signed the 'Agreement on Stabilisation of the SAS budget' in July 2015. The agreement secures SAS minimal annual income €60 for period 2016-2018.

The Slovak economy relies on the mid-tech manufacturing exports. The manufacturing generated about 20% of the total gross valued added in 2014. Exports accounted for almost 100% Slovak GDP in the same year. Two industries (manufacture of car and car components and consumer electronics) accounted for over 40% of total Slovak exports of goods in 2014. Slovakia has a dual economy. One sector was dominated by branches of the multinational enterprises (MNE), second sector consisted of some 185 thousands (domestically-owned) small and medium companies (SMEs) in 2015. The Eurostat data indicate that the turnover from innovation generated 19.6% of total turnover in Slovak companies in 2012 (EU28: 11.9%). The 2015 Innovation Union Scoreboard data specify that Slovak companies accounted for above-average rates in non-R&D innovations (1.16 times of the EU28 average). Several of the components of innovation expenditure, such as investment in equipment and machinery and the acquisition of patents and licenses, measure the diffusion of new production technology and ideas[8]. The Slovak R&D investments in the business sector accounted only for 29% of the EU28 average.

The Slovak gross expenditure on research and development (GERD) was €669.6m (0.89% of GDP) in 2014 (2013: €610.9m and 0.83% GDP). The 2014 National Reform Programme for the Slovak Republic set 2020 targets for GERD and the business expenditure on research and development (BERD) to 1.2% and 0.8% respectively. The target seems realistic. There were significant increases in business research spending since 2008 (albeit from extremely low base). Most of the increase likely related to co-financing the Structural Fund projects by the Slovak companies. The Slovak target in GERD (1.2% GDP), however, is rather unambitious compared to those by Hungary (1.8%) and Slovenia (2.0%).

The Slovak Republic takes over the Presidency of the Council of the European Union in July 2016. Mr. Robert- Jan Smits – Director General at the Directorate-General for Research and Innovation (DG RTD) had meeting with the MESRS representatives in July 2015. Mr. Smits and the MESRS agreed on the Slovak thematic research priorities in fields of start-ups and cybersecurity. Support to young researchers is a horizontal research priority for the Slovak Republic. [9]

[7] Slovak per capita GDP was 75.2% of the EU28 average in terms of purchasing power parity. Source: Eurostat.
[8] Source: European Commission (2015): Innovation Union Scoreboard 2015. Annex H. Performance per indicator.
[9] MESRS (2015): *Robert – Jan Smits: „Slovensko má veľký potenciál"* {*Robert – Jan Smith: 'Slovakia has a significant potential'*}, the MESRS press release of 14 July 2015.

**Table 1:** Main R&I indicators 2012-2014

| Indicator | 2012 | 2013 | 2014 | EU average |
|---|---|---|---|---|
| GDP per capita | 13,400 | 13,600 | 13,900 | 27,400 |
| GDP growth rate | 1.6 | 1.4 | 2.5 | 1.4 |
| Budget deficit as % of GDP | -4.3 | -2.7 | -2.7 | -3.0 |
| Government debt as % of GDP | 52.4 | 55.0 | 53.9 | 86.8 |
| Unemployment rate as percentage of the labour force | 14.0 | 14.2 | 13.2 | 10.2 |
| GERD in €m | 585.2 | 610.9 | 669.6 | 283,009.4 |
| GERD as % of the GDP | 0.81 | 0.83 | 0.89 | 2.03 |
| GERD (EUR per capita) | 108.3 | 112.9 | 123.6 | 558.4 |
| Employment in high- and medium-high-technology manufacturing sectors as share of total employment | 10.2 | 9.8 | 9.4 | 5.7 |
| Employment in knowledge-intensive service sectors as share of total employment | 31.9 | 32.8 | 34.0 | 39.8 |
| Turnover from innovation as % of total turnover | 19.6 | x | x | 11.9 (2012) |
| Value added of manufacturing as share of total value added | 30.0 | 32.6 | x | 26.2 (2012) |
| Value added of high tech manufacturing as share of total value added | 2.5 | 2.1 | x | 2.5 (2012) |

Source: Eurostat

## 1.2 Structure of the national research and innovation system and its governance

### 1.2.1 Main features of the R&I system

The Slovak Republic accounts for a highly centralised system of research, innovation and higher education. The research, higher education and innovation traditionally have been considered matters of central government. The 302/2001 Law on Self-Governing Regions makes no references to competences in support to regional innovation and research systems. The support to human resources (secondary education in particular) is the most important competence Slovak NUTS III regions have in field of innovation development.

The Slovak R&I system is funded mainly from the government and business resources. The HEIs, the public research institutions and businesses are the main research performers. The non-profit sector is of minor importance for the R&I funding and performance in Slovakia. The structure of research spending changed in last six years. Public sector (central government) was a major provider of research funding in 2000s. Since 2010 business resources and funding from abroad (European Commission) significantly increased in importance. The business and private-non-profit research bodies funded 34.7%, HEIs 0.3%, government 52.3% and foreign funders 12.3% of the total research funding in 2008. The respective shares changed to 32.7%, 2.2%, 41.4% and 23.7% by 2014. The Eurostat data on business research spending indicated that the foreign owned businesses performed 78% of the total intra-mural research in the Slovak Republic in 2011 (latest available data). Data on research spending by the MNE are scarce in the Slovak Republic. The Eurostat data on the direct investment positions by economic activity indicate a quite low stock of the FDI in the Slovak Republic in 2012 (see chapter 3.3.2 for more details).

### 1.2.2 Governance

The Slovak system of research and innovation (R&I) governance accounted for no significant changes in the last three years. The national research and development policies are drafted, implemented and co-ordinated by the Ministry of Education, Science, Research and Sports (MESRS). The MESRS co-operates with other ministries (Ministries of Economy and Finance in particular), the Slovak Academy of Sciences (SAS), HEIs, and associations of employers, and industrial research organisations, respectively (Figure 1). The most important body for co-ordination of S&T and innovation policies is the Slovak Government Council for Research, Development and Innovations (SGCSTI). The SGCSTI also is an advisory body of the Slovak Government in matters of science, research and innovation. The secretariat of the council is administrated by the MESRS. The council is chaired by the Prime Minister. Co-chairs of the SGCSTI are Minister of Education, Science, Research and Sport of the Slovak Republic, Minister of Economy, Minister of Finance and Chairman of the Slovak Academy of Sciences. The SGCSTI discusses and evaluates mainly conceptual, strategic and financial plans in science, technology and innovations designed for the Slovak Government, European Union bodies and international organisations. The Rector Conference and the SAS are the main advisory bodies for the Slovak Government on R&I.

The drafts of the R&I policies are provided for public consultations by key stakeholders and broader public. The current key R&I document is the Smart Specialisation Strategy for the Slovak Republic for 2014-2020. Multi-annual budgetary framework is provided by the Ministry of Finance. The ministry regularly publishes drafts of the state budgets and three-year budgetary outlook for public administration. Funding for research and higher education was quite unstable, and subject to intense negotiations between the Ministry of Finance on one hand, and the HEIs and the SAS on the other hand in 2010-2014. Predictability of the budgetary framework somewhat improved in 2015, when the Ministry of Finance fixed the SAS budget for three years.

The MESRS supports basic and applied research via state budget allocations and competitive grants. The grants are given to a network of organisations and agencies important for development of science & technology (S&T) and higher education. The SAS has its own chapter in the State Budget Law. For more details on key research performers and funders see chapter 3.

The evaluation culture is rather underdeveloped in Slovakia. The MESRS has published the Annual Report on R&D since 2006. The reports list major public funding schemes and organisations, and provide details on numbers of supported projects and amount of support. The latest editions of the report also list some output indicators (publications, citations, patents) and provide for basic international benchmarking. The reports, however, do not account for the fully-fledged ante and ex-post evaluation tools and impact analyses. They contain no comparable information about the quality and efficiency of funding through R&I programmes. The reports seemed to have little impact on improvement of the national system of R&I. The Slovak Research and Development Agency (SRDA) (major source of the national project funding) publishes annual reports on its activities, but gives no analytical assessment on the efficiency of the public support to R&D. The accreditations of the Slovak HEIs and the SAS also seem to have little impact on the performance of the HEIs and the SAS. The Slovak HEIs and the SAS underperform in the Scimago and Webometrics rankings (see chapter 2.2.1 for more details). The 2015 Innovation Union Scoreboard also ranked the Slovak Republic to the poorest R&I performers in the EU28. No macroeconomic models have been used to assess the impact of R&I on economic growth in the Slovak Republic.

### 1.2.3 Research performers

The HEIs and the SAS are the key research performers in the Slovak Republic. There are 36 HEIs, of which 20 public and 16 private ones in Slovakia. The public HEIs provide for teaching and research. The private HEIs concentrate on teaching in social science and humanities. There was only one private HEI in the Scimago list of major research

performers in 2015 in Slovakia (Annex 1). The SAS was the most important research performer in terms of research outputs and institutional funding in the same year (Annex 1). Some sectoral ministries were running their own research and intelligence institutes. The Ministry of Labour, Social Affairs and Family, for example, managed the Institute for Research in Labour and Family. The Ministry of Finance runs the Financial Policy Institute. There were some 200 private companies reporting research activities by 2015 in Slovakia. Information on private research performers, however, was quite scarce. Few Slovak companies published information on their research spending. The structure of research spending changed in last six years. The business and private-non-profit research bodies performed 43%, HEIs 24% and government organisations 33% of the total research in 2008. The respective shares changed to 37%, 23% and 28% by 2014.

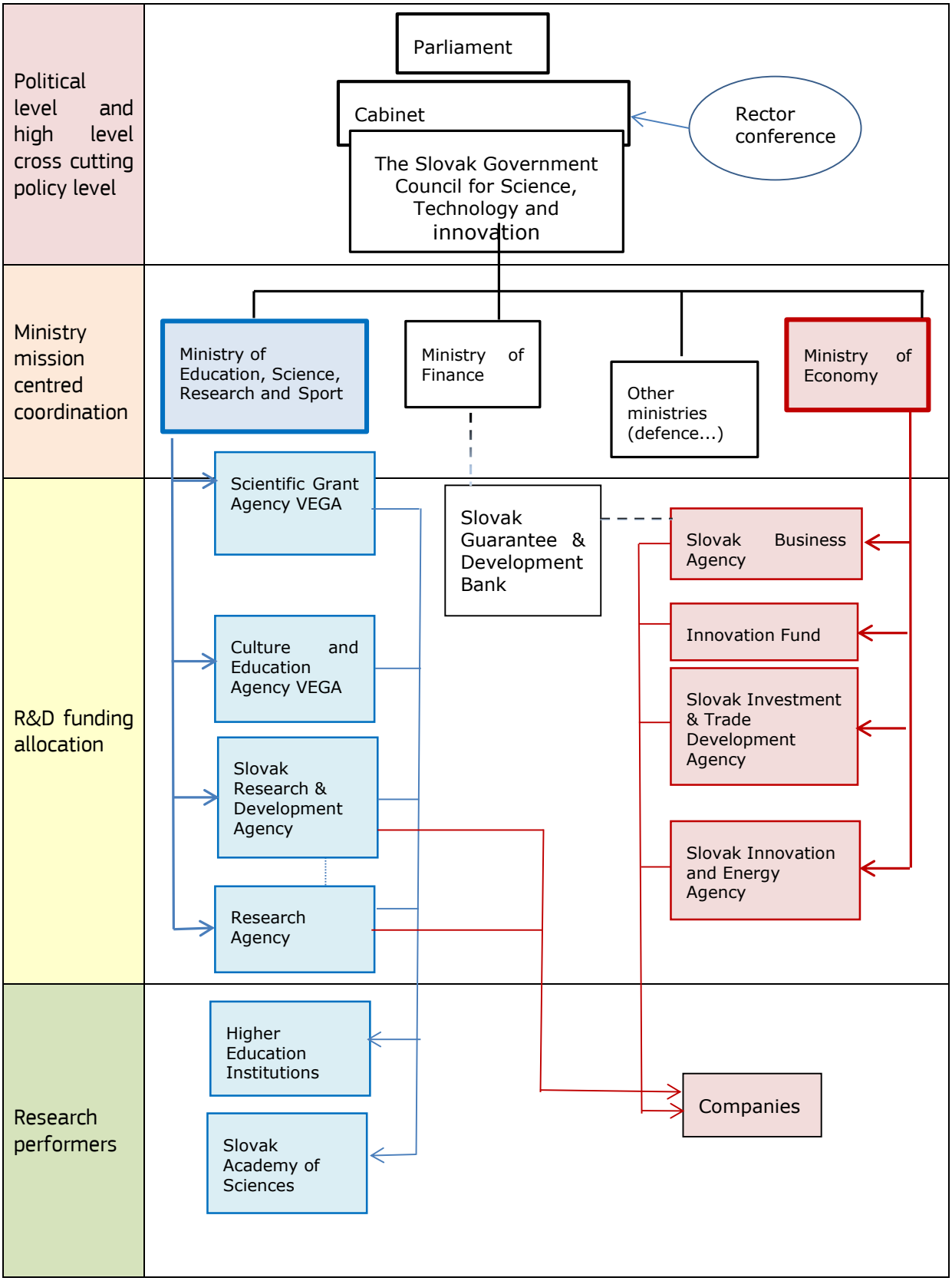



**Figure 1** The organigram of the Slovak national research and innovation system[10]

[10] SARIO has no budget or any competences for funding allocation for R&D.

# 2. Recent Developments in Research and Innovation Policy and systems

## 2.1 National R&I strategy

The 2007 'Long-term Objective of the State S&T Policy up to 2015' and the 2007 'Innovation Strategy for 2007-2013' were the first strategic documents on research and innovation in Slovakia. Both documents were superseded by the national Smart Specialisation Strategy (RIS3 document). The Slovak Government passed the final version of the RIS3 document via the Government Resolution no. 665/2013 on 13 November 2013. The document is the national R&I strategy for 2014-2020. It covers research and innovation in an integrated manner. The chapter 2 of the document presents international analysis of strength and weaknesses of the Slovak economy and its emerging opportunities.

The strengths and weaknesses are summarised in chapter 3 of the RIS document. Based on the analytical chapter, the RIS3 document sets goals and policy measures aimed at research, innovation and education:

- Goal 1 tackles challenge of the dual economy and aims at increasing embeddedness of key industries in Slovakia. The RIS3 document proposes policy measures aimed at (i) increasing embeddedness by the MNE in Slovakia's economy; (ii) improving integration of the Slovak firms into the global value chains; and (iii) support to clusters and joint research centres by public and private sectors.
- Goal 2 relates to support to economic growth via results of excellent science. The goal reflects EU priorities in international co-operation in science technology. The goal aims at exploiting opportunities for joint programming, cross-border co-operation and the leverage effects of EU instruments. The Measure 2.1 'Fostering excellence in research' aims at 'improving international co-operation and excellence' and 'integration of Slovak science to the European Research Area'. The Measure 2.2 'Development of excellent research while ensuring the necessary infrastructure for research and development' envisages grants supporting ESFRI infrastructure projects. The Measure 2.4 'Systemic support to and stimulation of international co-operation in science and technology' aims at improving Slovak participation in the Horizon 2020, ERC and ERANET programmes, joint programming, and cross-border co-operation.
- Goal 3 'Creating dynamic, open and inclusive innovative society as a condition for improving quality of life' contains three policy measures on grand societal challenges. Indicative set of the grand societal challenges Slovakia wants to solve by means of co-operation within the ERA includes population ageing, youth unemployment, inclusive society, and environmental issues.
- Goal 4 'Improving quality of human resources for innovative Slovakia' contains policy measures aimed at improving system of vocational education and supporting excellent higher education.

- The RIS3 document noted a lack of thematic and sectorial focus, and indicated prospective sectors of economic specialisation and related research themes. The RIS3 document identifies four key areas of economic specialisation: (1) automotive and mechanical engineering industries; (2) consumer electronics and electrical equipment; (3) information and communication technologies and services, and (4) production and processing of iron and steel. The document also lists 'prospective areas of specialisation', such as (a) automation, robotics and digital technology; (b) processing and increasing the value of light metals and their alloys; (c) production and processing of plastics; (d) creative industry, and (e) increasing the value of domestic raw material base.

The RIS3 document also identifies four areas of specialisation form the point of view of available scientific and research capacities: Research of materials and nanotechnology, Biomedicine and Biotechnology, Environment and agriculture and Sustainable energy.

The potential impact of the RIS3 document is significant. The key reforms envisaged by the RIS3 document, however, have not been implemented by end of 2015. The RIS3 document should be implemented by two Action Plans for Research and Innovation (for periods 2015-2016 and 2017-2020). In 2015 the MESRS drafted three versions of the Action Plan for the RIS3 document for period 2015-2016 respectively.

The Slovak Government rejected two versions of the Action Plan. Major difficulties relate to the reform of the R&I governance. The final draft was approved by the Slovak Government Council for the Science, Technology and Innovation (SGCSTI) on 4 September 2015 and sent to the European Commission for further comments. The final draft concentrated on legislative measures aimed at (i) reform of funding agencies, (ii) transformation of the SAS, (iii) reform of higher and secondary education, (iv) introduction of new system of the R&D&I policy support measures, (v) introduction of evaluation framework for the RIS3, and (vi) preparation of the national ESFRI Roadmap. These measures should stimulate business R&D expenditure and applied research, as well as increase excellence of science. The final draft of the Action Plan also (a) suggested set of indicators for evaluating RIS3, and (b) set time plan of the RIS3 evaluations. None of these policy measures were adopted by December 2015 (except for the tax reliefs for R&D).

The chapter 5.2 of the RIS3 document envisaged some important reforms of the R&I governance system. Slovakia, for example, accounts for low amount of national R&I funding, but has as much as eight agencies for R&I support. Five research funders managed by MESRS should merge to the 'Research Agency', while three innovation support agencies managed by the Ministry of Economy should merge to the 'Technology Agency'. The merger should (i) increase thematic focus of public support to R&I; (ii) remove fragmentation of public support to R&I; (iii) avoid duplications of R&I schemes; and (iv| create critical mass for support to R&I in selected areas. The Slovak Government have not implemented any reforms aimed at removal of fragmentation of public support to R&D by end of 2015. It rather amended statutes of two incumbent funders (ASFEU and SIEA) and credited these bodies with some tasks of the Research Agency and the Technology Agency respectively in 2015.

Most policy goals and policy measures of the RIS3 document are financed via the Operational Programme Research and Innovation (OPRI).

The Slovak Government approved the OPRI via Resolution no 230/2014 on 14.05.2014. The OPRI contains five Priority Axes with significant allocations in period 2014-2020:

1. Support to research, development and innovations (€2,945.84m);
2. Support to research, development and innovations in the Bratislava Region (€299.67m);
3. Strengthening competitiveness and growth by the small and medium enterprises (€592.53m);
4. Strengthening competitiveness and growth by the small and medium enterprises in the Bratislava Region (€49.99m);
5. Technical assistance (€60.0m).

In total the OPRI allocates €3988.00m, of which €2,226.78m from the EU resources, €272.40m from national public resources, and €1,468.84m from national private resources. The societal priorities may be funded via the OPRI as well.

In July 2015 the Ministry of Education, Science, Research and Sports drafted an indicative list of eight OPRI calls for 2015-2016. Five of these calls are aimed at achieving the RIS3 targets: (1) Target 1.1.2 'Synergic and complementary finance for international projects in area of RIS3', €25m; (2) Target 1.2.1 'Support to R&D in individual industrial R&D centres in area of RIS3', €190m; (3) Target 1.2.1 'Support to long-term strategic research in area of RIS3', €150m; (4) Target 1.1.3 'Modernisation and further development of technology basis in non-business R&D institutions in area of RIS3', €35m; and (5) Target 2.1.1 'Mobilising excellent research teams in area of RIS3

in the Bratislava Region', €15m. Calls under targets 1.2.1, 1.1.3 and 2.1.1 included a significant innovation. They were open for research organisations from the EU Member Countries. Calls implemented under the operational programmes 'Research and Development' and 'Competitiveness and Economic Growth' were accessible only to Slovak research organisations and private bodies in period 2007-2013/15.

## 2.2 R&I policy initiatives

The Slovak Republic ranks among the weakest R&I performers in the EU (i.e. the results of the 2015 European Innovation Scoreboard). It indicates that public action in most relevant policy areas is not optimally designed/implemented in a strategic, coherent and integrated framework and tailored to foster innovation and strengthen the knowledge base and fundamental research. The RIS3 document recognised the weaknesses of the Slovak R&I system and suggested a number of policy initiatives for fostering research and innovation. The most important R&I policy initiatives include the RIS3 document in 2013 (see chapter 2.1) and introduction of the tax reliefs ('super deductions') for the R&D since 2015 (see chapter 3.5.2).

The tax reliefs for R&D may boost R&D expenditure reported by the Slovak companies. Slovak business expenditure on R&D (BERD) ranks to the lowest in the EU28. The Slovak BERD, however, is likely to be underreported. There was no benefit, but lot of administrative burden related to statistical reports on the R&D expenditure in Slovakia prior to 2015. Tax reliefs for R&D introduced in 2015 may motivate Slovak companies to (i) report their R&D expenditure correctly, and (ii) increase actual R&D spending.

The innovation and education aspects traditionally were treated separately in Slovakia. The education and research policies fell under aegis of the MESRS. The Ministry of Economy designed and implemented innovation-related policies. The RIS3 document presented plans for integrated design and implementation of the research and innovation policies. The plans, unfortunately, were not translated to specific policies by end of 2015. The Slovak Republic had no strategic policies for investments in research infrastructures (see chapter 4.2.2 for more details).

**Evaluations, consultations, foresight exercises**

The Slovak Republic adopted some monitoring and review mechanisms (based on output indicators and international benchmarking) to evaluate performance of the public research institutions, HEIs, and research programmes and projects. These mechanisms provide relatively accurate and comparable information about the amount (but not efficiency) of funding from public resources. The evaluation culture, however, is underdeveloped, in terms of funding efficiency and impacts in particular.

The Slovak Government and the Ministry of Education, Science, Research and Sports (MESRS) have published the Annual Report on Research and Development since 2006. The reports list state expenditure on various R&D schemes, and also provide for some basic international benchmarking. The reports, however, do not include the impact evaluation (see chapter 1.2.2).

The Ministry of Economy published annual reports on implementation of the 2007 Innovation Strategy. The strategy was superseded by the RIS3 document in 2013. No evaluation of innovation policies was published in period 2013-2015.

The Structural Funds schemes are evaluated on continuous and periodical basis. The monitoring reports (related to individual calls) and the annual reports for particular operational programmes tend to be rather formal. They concentrate on stating numbers of applicants, and volume of support required and awarded. The impact assessment procedures are underdeveloped, because of the lack of experts and techniques. The Slovak Government commissioned the 'Pilot project– contribution to the EU 2020 targets in research and development'. The study found that:

- The investments from the Operational Programmes 'Research and Development' and 'Competitiveness and Economic Growth' (OPRD and OPCEG respectively) significantly boosted revenues and assets in supported enterprises. The effects of the EU support on companies' own R&D spending remained unclear, as the supported enterprises were not obliged to report their own spending;
- The OPRD and OPCEG coped with limited absorption capacity. The survey with the project beneficiaries and interviews with the key stakeholders indicated that spending by the OPRD and OPCEG was slowed down by enormous administrative burden and problems with public procurement (see chapters 4 and 5 of the Pilot for project more details).

The main evaluation body for the Slovak HEIs is the Accreditation Commission of the MESRS. The Accreditation Commission classified HEIs in three categories: (a) 'Universities', (b) 'Higher Education Institutions', and (c) 'Professional Higher Education Institutions'. The commission approved new, more stringent rules in 2013. The rules put more emphasis on research excellence in terms of scientific papers published/cited in journals listed in the international scientific databases (WOS, SCOPUS), research monographs published with high-quality publishers and international patents.

The last evaluation round took place in 2014-2016 and covered period 2008-2013. The Accreditation Commission evaluated 4891 study programmes in 22 Higher Education Institutions (HEIs) by end of 2015. Five HEIs may lose their 'University' status and be downgraded to simple 'Higher Education Institutions'. The Accreditation Commission also did not approve 1756 study programmes, and abolished some 90 dislocated branches of the HEIs out of the total 110. Accreditation of the remaining 14 HEIs is scheduled to 2016.

The Slovak public system of higher education is heavily underfunded. The rules for funding allocation put considerable weight on numbers of students and encourage mass education. The results of evaluation have little impact on improvements in research performance of the HEIs (see chapter 3.4.2 for more details)[11]. The Accreditation Commission[12] launched project on 'Top Research teams in Slovak Universities' in 2014. Some 77 teams applied for evaluation. The Accreditation Commission used data provided by the Web of Knowledge and identified 37 top teams in 2015. The Universities with excellent research teams should be allowed to ask for higher funding from public resources.

The Slovak Academy of Sciences (SAS) evaluates its institutes since 1992. The last round was concluded in 2012. Results of evaluations; had little consequences for the SAS funding (see the 2014 Country Report for more details). The next round of evaluation is set for 2016.

[11] No Slovak University was included in the top 500 World Universities by the 2015 edition of the Webometrics. The Comenius University in Bratislava (no 634), the Slovak University of Technology in Bratislava (no 675) and the Technical University of Košice (no 768) fared best in the ranking.

[12] The Accreditation Commission has 21 members and 24 Working Groups for particular fields of science. Almost all members of the commission and the working groups are Slovak citizens. Slovak research sector is quite small and scientists working within the same research field use to know each other. The Accreditation Commission would no doubt benefit from membership by foreign and/or independent experts.

## 2.3 European Semester 2014 and 2015

The 2014 National Reform Programme (NRP) for the Slovak Republic listed government's plans for reform of higher education. The 2014 NRP, for example, announced intentions to 'cancel scientific-pedagogic and artistic-pedagogic titles of assistant professor and professor, while retaining only the relevant functional positions'. This should 'make the academic career more flexible and the system open also for persons interested from abroad or from practice'. No specific policy actions toward these targets were taken[13].

The 2015 National Reform Programme confirmed government's intention to implement the RIS3 document via the Action Plan of the Research and Innovation Strategy for Intelligent Specialisation of SR (RIS3) for 2015–2016. The 2015 NRP mentions the measures 'focused on the stabilisation of public funds and support to private R&D funding. The existing network of government funding institutions will be reduced. Financing will be focused on increasing the quality of research, promoting the infrastructure built from EU funds in the second programming period and connecting universities, science academies, research institutions and partners from the area of industry'.

The 2015 NRP also tackles the transformation of public research bodies. The Slovak Academy of Sciences should be transformed into a new type of public body, the so-called 'public research organisation' in 2016. As for the international cooperation in R&D, the Slovak Government would support the 'involvement of Slovak organizations in the European networks and programmes such as Horizon 2020, Danube Strategy, ECSEL, EIT, and ESFRI'. The Annex 2 to the 2015 NRP (Action Plan) listed two important tasks in area of R&I to be implemented by June 2015: (1) reform of the R&D funding system; and (2) Action plan for the implementation of Research and Innovation Strategy for Smart Specialisation of SR (RIS3) 2015 – 2016'. None of these tasks was finished by end of 2015.

The 2015 Country Specific Recommendations (CSR) for the Slovak Republic made no specific observations on the research, development and innovations. The CSR noted 'some progress in relation to work-based learning, with a new Act on vocational education and training to enter into force in 2015'. The 2015 Slovakia's Country Report (staff working document) noted the halted reform in higher education and no progress in 'introducing more quality-based funding criteria for public higher education institutions and encouraging the creation of profession-oriented bachelor programmes by institutions'. The Country Report also pointed to fact that the 'low quality and lack of industrial relevance of the science base impedes the emergence of a well-functioning research and innovation ecosystem in Slovakia'.

The Country Report then lists some long-term challenges for developing an efficient national system of research and innovation in Slovakia: (i) poor co-operation between the academia and industry sectors; (ii) delayed reform of public research bodies; and (iii) low innovativeness of the Slovak economy (for structural challenges see chapter 6).

The important action in research and innovation policy was introduction of the tax reliefs for the R&D.

## 2.4 National and Regional Research and Innovation Strategies on Smart Specialisation

The RIS3 document is a multi-annual plan, but it does not provide for predictable budgetary framework. The 2.0 draft version of the RIS3 document contained detailed indicative financial allocations for particular policy measures. The government approved final version of the RIS3 document with no financial allocations. National support to science and technology is determined by the Ministry of Finance and presented in the

[13] The annex of the 2014 NPR contains lists of legislative to draft by end of 2013 and early 2014. Most of these were not ready by end of 2015.

three-year Proposal for Budget of Public Administration. The RIS3 document presents plans for (i) changing shares of support to basic and applied research from current ratio of 2:1 to 1:2 by 2020; and (ii) introducing 'mandatory indicator of the state support to R&D as percentage of GDP in the State Budget Law'. The proposed 2015-2017 Budget of Public Administration contains no actions supporting these plans and foresees decreases in national public support to R&I.

The monitoring and evaluation arrangements are considered in the chapter 8 of the RIS3 document. The chapter foresees 'regular reporting for needs of the Slovak Government and the European Commission'. The Standing Committee of the Slovak Government Council for the Science, Technology and Innovation (SGCSTI) is responsible for monitoring while the Analytical Department of the Government Office provides for evaluation of 'measurable outputs, results and impacts of policy measures implemented under the RIS3'. The chapter 8 also assumes corrective actions 'in case the implementation of the RIS3 policy measures does not generate expected results'. The RIS3 document has not been implemented by specific policy actions by end of 2015. Efficiency of the RIS3 monitoring mechanism therefore is impossible to asses.

The Slovak self-governing regions have no competences in research and higher education, and fairly limited competences in field of innovation. If a region wants to support research and innovation, the usual way is to include these items into 'support to regional planning and development'. Support to human resources (secondary education in particular) is the only important competence Slovak regions have in field of innovation development.

The regional governments commissioned two generations of regional of innovation strategies (RIS). The first generation of the RIS3 was drafted in period 2004/2006 and applied till 2013/2014. In 2013-2014 the regional governments used financial assistance from the Regional Operational Programme and commissioned second generation ('smart-type') of the RIS. The 'Strategy for Development of Regional Research and Innovation Base of the Bratislava Region in period 2014-2020' was the only smart-type RIS document available by end of 2014. The first and second generations of the RIS, however, contain no mandatory plans for implementation of regional policy measures. Almost all measures supporting R&D and innovation are designed, implemented and evaluated by the central government agencies (SIEA and Research Agency in particular). The central government may consider targets and policy tools suggested by the regional innovation documents, but is not bound to adopt them. The regional innovation strategies, in fact, are more 'wish lists' than real planning documents in Slovakia. The Operational Programme Research and Innovation is major source of funding for R&I policies mentioned in the regional innovation strategies.

The Slovak Innovation and Energy Agency presented a study on impact of clusters on economic development of the regions in December 2015. The study mapped activities of the Slovak cluster organisations and proposed specific policy measures supporting development of clusters in the Slovak regions[14].

[14] Balog, M. (2015): *Klastrová politika v podmienkach Slovenska* {*The Cluster Policy in Slovakia}, Bratislava, Slovak Innovation and Energy Agency.*

## 2.5 Main policy changes in the last five years

| **Main Changes in 2011** |
|---|
| The Slovak Government Council for Science, Technology and Innovations (SGCSTI) was established by the Government Resolution No. 620/2011 on 28 September 2011. The SGCSTI is top governance body for research and innovations in Slovakia.<br>The Slovak Government passed the 2011 Innovation Policy document via the Government Resolution No 302/2011 of 11th May 2011.<br>The Fenix Strategy: Update of the Long-Term Objective of the State Science and Technology Policy up to 2015 was passed via the Government Resolution No. 467/2011 on 06.07.2011<br>The Slovak Government Council for Science, Technology and Innovations (SGCSTI) was established by the Government Resolution No. 620/2011 on 28 September 2011. The SGCSTI is top governance body for research and innovations in Slovakia. |
| **Main changes in 2012** |
| The Ministry of Economy drafted an amendment of the 181/2011 Law on Subsidies as to include innovation, research and development to the list od supported activities. The Slovak Government approved the draft via its resolution No. 643/2012 of 28.11.2012 and earmarked some €300,000 for support to innovation and R&D. |
| **Main changes in 2013** |
| The SGCSTI met for the first time on 9 April 2013 to discuss the first draft of the Smart Specialisation Strategy (RIS3 document).<br>The final version of the RIS3 document was passed via the Government Resolution no. 665/2013 on 13 November 2013. The Smart Specialisation Strategy is the first policy document integrating research and innovation policies in Slovakia. |
| **Main Changes in 2014** |
| The Slovak Government approved the Operational Programme Research and Innovation (OPRI) via Resolution no 230/2014 on 14.05.2014. The OPRI contains five Priority Axes with significant allocations in period 2014-2020. In total the OPRI allocates €3988.00m, of which €2226.78m from the EU resources, €272.40m from national public resources, and €1468.84m from national private resources. The OPRI is major source of finance for the Slovak R&D system in period 2014-2020 |
| **Main Changes in 2015** |
| Tax reliefs for R&D entered into force on 1st January 2015<br>The Slovak Government renamed the Agency for the Structural Funds of the European Union (ASFEU) to the Research Agency (RA). The RA should, inter alia, 'create conditions for participation by the Slovak research teams in the European Research Area in general, and in the ESFRI, EITI, technology platforms and Horizon 2020 in particular'.<br>The Slovak Government adopted the 'Concept paper for the support of start-ups and the development of the start-up ecosystem in the Slovak Republic' on 10 June 2015. The concept paper listed government's intention on support to start-ups: (a) developing legal concept of start-up in Slovakia; (b) passing government strategy on start-ups; (c) introducing new form of business entity, with basic capital of 1 euro; (d) introducing tax reliefs for start-ups and business angels; and (e) introducing start-up visa for the third country nationals in Slovakia. |

# 3. Public and private funding of R&I and expenditure

## 3.1 Introduction

The Slovak national system of R&I ranks to the poorest in terms of inputs (financial resources) and outputs (scientific and commercial ones) in the European Union. As for the R&D expenditure, Slovakia significantly lags behind EU average and its competitors among the Visegrad 4 (V4) Members. Unlike the Czech Republic, Slovakia was unable to catch-up with the influx of the foreign direct investment in the R&D sector. Slovakia also was unable to increase its public expenditure on R&D. Nevertheless, there also have been some positive trends (Table 2, Figure 3). The Slovak R&D expenditure reached bottom in period 2004-2009 with 0.45% of GDP. There was a positive upturn in 2010. The Slovak GERD increased to 0.89% GDP in 2014.

**Table 2:** Basic indicators for R&D investments

| Indicator | 2011 | 2012 | 2013 | 2014 | EU average (2014) |
|---|---|---|---|---|---|
| GERD (as % of GDP) | 0.67 | 0.81 | 0.83 | 0.89 | 2.03 |
| GERD (Euro per capita) | 86.9 | 108.3 | 112.9 | 123.6 | 558.4 |
| GBAORD (€m) | 323.598 | 297.706 | 289.234 | 295.68 | 92,828.15 (Total EU-28) |
| R&D funded by BES (% of GDP) | 0.23 | 0.31 | 0.33 | 0.29 | 1.12 |
| R&D funded by PNP (% of GDP) | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| R&D funded by GOV + HES (% of GDP) | 0.34 | 0.35 | 0.34 | 0.39 | 0.68 |
| R&D funded from abroad | 0.09 | 0.15 | 0.15 | 0.21 | 0.20 |
| R&D performed by HEIs (% of GDP) | 0.23 | 0.28 | 0.27 | 0.31 | 0.47 |
| R&D performed by government sector (% of GDP) | 0.18 | 0.20 | 0.17 | 0.25 | 0.25 |
| R&D performed by business sector (% of GDP) | 0.25 | 0.34 | 0.38 | 0.33 | 1.33 |

Source: Eurostat.

The gross expenditure on research and development (GERD) has been on the rise in the European Union in last ten years, including a period of economic turmoil. The Slovak Republic (and also other V4 countries) accounted for higher growth in GERD compared to the EU28 average. GERD levels in the V4 countries, however, rose from the relatively low levels. The Czech Republic accounted for the most impressive growth in GERD among the V4 group. Slovakia, on the other hand, resembled to the Malta, Cyprus, Romania and Greece, and accounted for low growth in GERD. The low growth of the Slovak GERD contrasted with the high growth of GERD in Slovenia and Estonia. The Eurostat data on GERD gives details on different sources of finance from abroad (European Commission). Data on R&D finance by 'enterprises within the same group' indicate that expenditure by branches of the MNE was an important source of business R&D finance in the Czech Republic, Poland and Hungary. The rise in BERD by domestic firms was more important than rise in BERD by foreign firms in Slovakia.

The public expenditure on R&D stagnated in Slovakia since 2009. The Slovak Government kept support to HEIS almost unchanged, while support to the Slovak Academy of Sciences decreased in nominal terms since 2010. Since 2008 foreign resources became increasingly important for funding R&D in Slovakia. The European Commission was a prime foreign funder for the Slovak system of research and innovation. The Slovak research bodies obtained funding €78.0m from the FP7 projects in period 2007-2014. The Slovak Republic benefited from the Structural Funds much more than from the Framework Programmes. The total indicative budget for four operational programmes associated with R&I was €2124.4m in period 2007-2013/2015 (Table 3). The total indicative allocation by the OPRI is €3707m for period 2014-2020 (of which €2268m is provided by the European Commission and €1440 is the national co-financing). Promotion of science and innovation ranks to the main funding priorities of

the Slovak Republic in period 2014-2020. The thematic objective 1 'Strengthening research, technological development and innovation' allocates €1849m, some 12.1% of the total allocations by the Partnership Agreement[15].

## 3.2 Smart fiscal consolidation

### 3.2.1 Economic growth, fiscal context[16] and public R&D

The Slovak Republic had a very strong GDP growth before the crisis and it weathered the 2008-09 economic crisis with a relatively moderate one-off income loss of 5.3% in 2009. However, indirect losses occurred in form of lower potential GDP due to weakened demand resulting in more moderate growth levels during 2010-2013. After being at 1.4% in 2013, and 2.5% in 2014 it accelerated to 3.5% in 2015 driven by a recovery in domestic demand, namely in private consumption and investment. The EC expects real growth to remain strong throughout 2016-2017 varying between 3.2-3.4% driven by domestic demand, both consumption and investment.

Pre-crisis public finances were relatively sound with deficit levels close to the 3% reference value as well as low and decreasing public debt (2005: 33%, 2008: 28%, Figure 2, below). With the onset of the crisis, the headline deficit peaked in 2009 at 7.9% of GDP and public debt increased to 36%, i.e. by almost 8% pa. Fiscal adjustment started in 2010, but the most significant consolidation steps were done in 2011 reducing the deficit by 3% both nominally and in structural terms and curbing also the increase of the debt. By the end of 2015, the headline deficit declined to 2.7%, public debt stood at 52.3%. The deficit is expected to decrease further in 2016-17 to 2.1% as well as 1.7% due to broadening of corporate income tax base, improvements in VAT tax compliance and favourable macroeconomic developments. Public debt is expected to slow down further, reaching 51.2% by the end of 2017. On the medium to long run increases in age-related costs affect the sustainability of public finances due especially to healthcare expenditures as the pension system is on a more sustainable path.

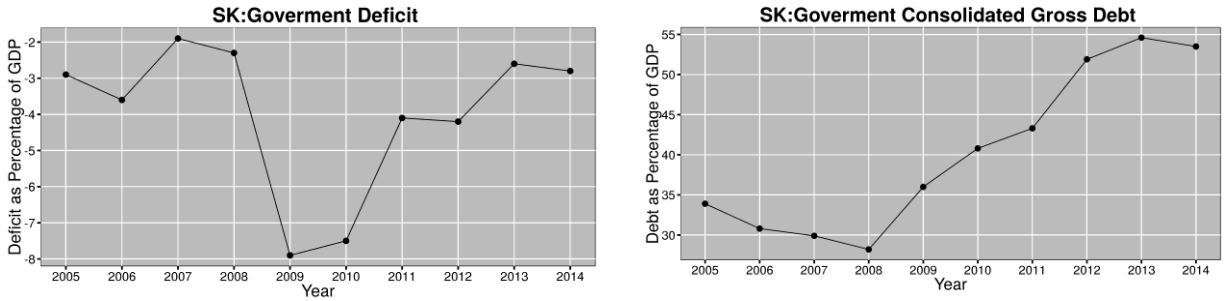



**Figure 2:** Government deficit and public debt
Data source: Eurostat

Total GERD in the Slovak Republic was 670 MEUR in 2014. There are three main sources of R&D funding: the business sector (216 MEUR), the government (277MEUR), and foreign funding (159 MEUR). Direct funding from the government goes to R&D in business enterprises (9.7 MEUR), the government (111.9 MEUR) and the higher education sector (155.4 MEUR).

[15] Source: The European Commission (2014): Summary of the Partnership Agreement for Slovakia, 2014-2020, Brussels, 20 June 2014.
[16] Sources: DG ECFIN http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_slovakia_en.pdf

**Table 3:** Key Slovak Public R&D Indicators

| | 2007 | 2009 | 2013 |
|---|---|---|---|
| GBAORD, % of gov. exp. | 0.57 | 0.82 | 0.96 |
| GERD, % of GDP | 0.45 | 0.47 | 0.83 |
| out of which GERD to public, % of GDP | 0.27 | 0.28 | 0.44 |
| Funding from GOV to, % of GDP | | | |
| Business | 0.02 | 0.01 | 0.02 |
| Public (GOV+HES) | 0.23 | 0.22 | 0.30 |
| Total | 0.24 | 0.24 | 0.32 |
| EU funding, % of GDP | 0.01 | 0.01 | 0.10 |

Source: Eurostat

### 3.2.2 Direct funding of R&D activities[17]

Figure 3, below shows the historical evolution of GERD financing in current prices in Slovakia.

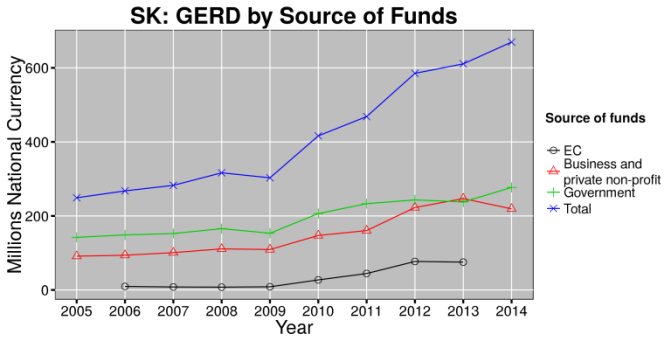



**Figure 3** Development of government funding of the total GERD

Data source: Eurostat

One observes a strong growing trend in the total GERD starting from 2009 (Figure 3). This is due to the concurrent growth of the GERD funded by the government, the private sector and the EC. While until 2013 private resources were the main funding category of the GERD, in 2014 the importance of public funding outweighed private ones for the first time. The EC plays an extremely important role and its funding amounts to about one third of the Slovak government GERD (see Table 2).

#### 3.2.2.1 Direct public funding from the government

Figure 4, below shows the time evolution of the total R&D appropriations (GBAORD) and the GERD directly funded by the government in units of millions of national currency.

[17] The sources of R&D funding according to the Frascati manual are: Government sector (GOV), Higher education sector (HES), Private non-profit sector (PNP) and Abroad (including EC). In this analysis the public sector as source of funds is given by the GOV part of the total intramural R&D expenditure (GERD), whereas the public sector as a sector of performance is the aggregation of GOV and HES.

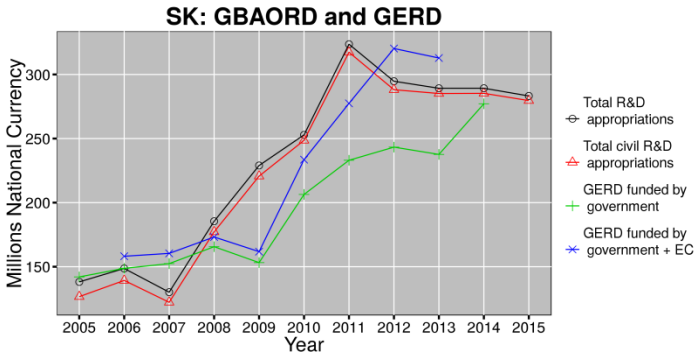



**Figure 4** R&D appropriations and government funded GERD in millions of national currency

Data source: Eurostat

The total (civil) appropriations grew nearly linearly in the period 2005-2011 stabilising at lower nominal levels in the following years. The total GBAORD increased considerably between 2007 and 2011. This was followed by a decrease from 2011 on, most probably as a result of budgetary cuts linked with the macroeconomic situation of the country. The small gap between the total and the total civil appropriations reveals the marginal levels of appropriations devoted to military R&D.

The EC contribution plays a vital role in the Slovak Republic as can be seen when it is added to the government GERD (blue line on Figure 4). Indeed, the growth of the government funded GERD slowed down significantly after 2011, but it is strongly supported by the funding from the EC. After a couple of years of stagnation government financed GERD increased significantly in 2014.

Public expenditure on R&D was set to 0.35% GDP in 2015 budget. There is a commitment to pass the 'binding indicator' of public expenditure on R&D as a share of GDP. The indicator sets annual increase in public expenditure on R&D by 0.04% till 2020 to reach 0.50% of the GDP by that year.

#### 3.2.2.2 Direct public funding from abroad

The EC is the main source of funding from abroad, not just the most important source of public funding (in recent years if clearly overtakes the funding from the business). On the other hand, the higher education and the other international organisations provide negligible funding from abroad.

**Table 4: Public** Funding from Abroad to the Slovak R&D (millions of national currency)

| Sources | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 15.0 | 24.2 | 28.9 | 38.9 | 38.7 | 61.1 | 66.3 | 109.1 | 109.7 | 158.6 |
| BES | NA | 12.0 | 17.2 | 25.9 | 25.2 | 28.5 | 14.5 | 24.2 | 28.4 | NA |
| EC | NA | 9.5 | 8.0 | 7.6 | 8.6 | 27.1 | 44.4 | 76.9 | 75.2 | NA |
| GOV | NA | 0.2 | 0.1 | 0.1 | 0.5 | 0.7 | 0.5 | 0.3 | 0.1 | NA |
| HES | NA | 0.1 | 0.6 | 0.8 | 0.3 | 0.4 | 0.3 | 0.2 | 0.3 | NA |
| Internat . Org. | NA | 2.6 | 3.1 | 4.3 | 4.1 | 4.0 | 6.6 | 7.3 | 5.2 | NA |
| Total as % GERD | 6.0 | 9.1 | 10.2 | 12.3 | 12.8 | 14.7 | 14.2 | 18.7 | 18.0 | 23.7 |
| EC as % GOVERD | NA | 6.4 | 5.3 | 4.6 | 5.6 | 13.2 | 19.1 | 31.6 | 31.7 | NA |

**Distribution of public funding**

Figure 5, below shows how the distribution of public funding to sectors of performance evolved over time:

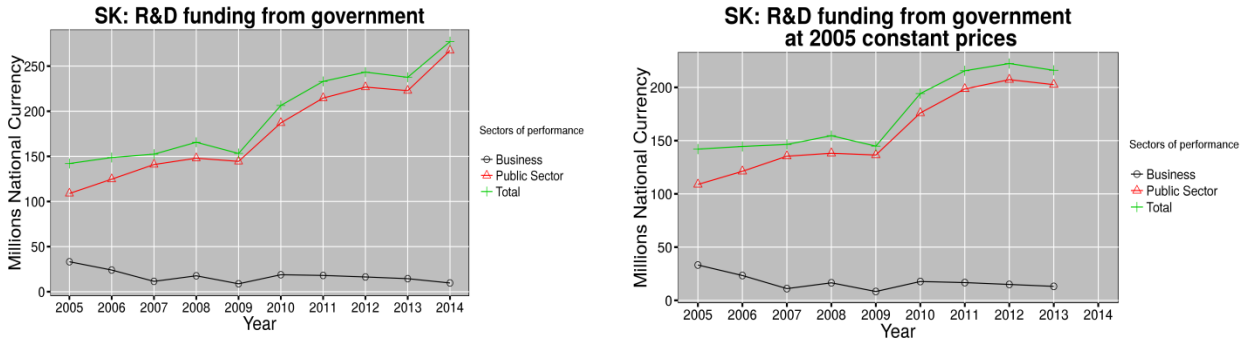



**Figure 5** Government intramural expenditure by sectors of performance.
Data source: Eurostat

Not surprisingly, the public sector (GOV + HES) is the main recipient of government funded GERD. It has an overall increasing trend, especially during the post-crisis period. On the other hand, the funding to the business sector registers a modest decrease after 2010. The use of the 2005 constant prices with respect to the nominal values does not substantially alter the observed behaviour of the funding from the government to the business and private sectors.

### 3.2.3 Indirect funding – tax incentives and foregone tax revenues

Considering the absence of harmonisation of the tax regimes in EU law, data come directly from national sources, using domestic definitions. Attention should be paid when interpreting data from different sources.

Conditions for granting and using incentives for R&D in Slovakia are stipulated in the Act 185/2009 on Research and Development Incentives[18]. These incentives are part of the Slovak state aid programme designated for legal entities – entrepreneurs, and are aimed at improving the quality of research and development activities.

The following areas are supported under the Act 185/2009:

- ✓ fundamental research, applied research or experimental development;
- ✓ feasibility studies of applied research and experimental research;
- ✓ industrial ownership protection;
- ✓ temporary lease of highly qualified research and development staff.
- ✓ Types of investment aid:
- ✓ Subsidies for research and development projects from the state budget;
- ✓ Income tax relief – at the amount incurred on research and development within the project for which incentives were approved.

In general, the eligible costs of research and development projects that qualify for the incentives depend on the type of research and development project. The Act 185/2009 provides a specific definition of eligible costs for some research and development areas with regard to micro, small, and medium-sized entrepreneurs:

- ✓ Direct costs – expenses incurred for activities for which it can be proved that they directly relate to the project;
- ✓ Indirect costs – costs of activities relating to the project, however not directly assignable to the project activities.

[18] https://www.vedatechnika.sk/SK/VedaATechnikaVSR/Legislatva/185_2009_z_o_investicnych_stimuloch.pdf

The amended of the 595/2003 Law on Income Tax was passed by the Slovak Parliament in October 2014 and entered in force on 1 January 2015. The amendment introduced tax 'super deductions' for business R&D performers. Any business R&D performer can claim the tax deduction. There is no need for prior approval by the MESRS. The tax deductions can be claimed for any thematic areas of research. The R&D performers can deduct from their tax bases 125% all R&D costs plus up to 25% labour costs in R&D in current year. Moreover the R&D performers can deduct 25% all R&D costs accrued in previous year. The Ministry of Finance estimated costs of tax reliefs for €26.4m in 2015 and €28.7m in 2016.[19]

There are a lot of limitations for companies claiming tax reliefs for R&D. This new law on Income Tax stipulates that the employee must be the a citizen of a EU Member State, younger than 26 years and no longer than 2 years after his/her graduation. Only a few young R&D employees can match these criteria, except perhaps IT specialists. Tax reliefs are not recognised for any R&D activity. Companies claiming tax reliefs must present their 'R&D projects' in advance, before the projects starts. The projects are published on the webpage of the Financial Directorate. Companies claiming tax reliefs must record profits in the current year. The Ministry of Finance insisted on these limitations as to combat potential tax frauds.

We currently have very little quantitative data to evaluate the impact of these measures of indirect funding (according to OECD, the indirect funding to R&D in 2012 amounts to a very negligible percentage of the GDP).

### 3.2.4 Fiscal consolidation and R&D

Figure 6, below shows the scatterplot of the structural balance on the one hand and GBAORD as % GDP, first panel as well as GERD as % GDP, second panel, on the other hand[20].

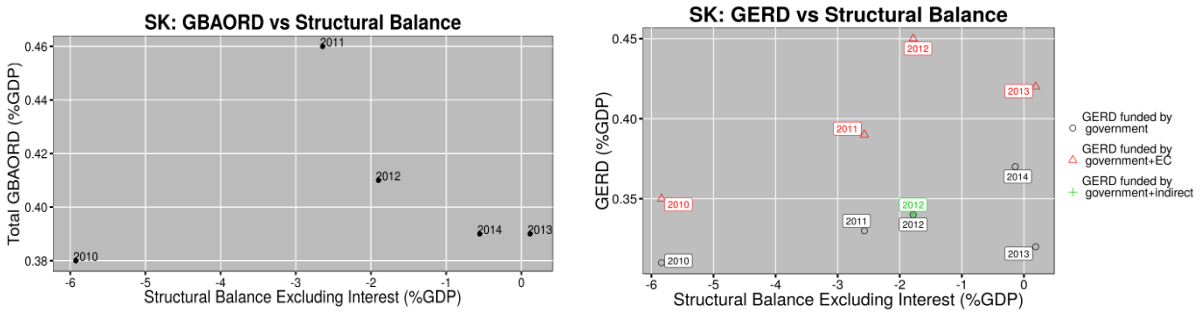



**Figure 6** Fiscal consolidation and R&D
Data source: AMECO, Eurostat, OECD

In the Slovak Republic post-crisis fiscal consolidation took place between 2010 and 2014 both nominally and structurally. The GERD funded by the government shows a moderate growth when expressed as a percentage of GDP in the years 2010-2014, but the addition of the EC contribution changes somewhat this picture reflecting a stronger growth and correlation between the GERD and the structural balance. We further stress that, even without the EC contribution, the government GERD, expressed as fraction of GDP, is preserved during the fiscal consolidation.

19
https://www.financnasprava.sk/_img/pfsedit/Dokumenty_PFS/Profesionalna_zona/Dane/Metodicke_pokyny/Priame_dane/2016/2016.04.19_MP_par30c.pdf.

20 Structural balance data comes from the AMECO database the other indicators were taken from Eurostat and OECD.

When we examine the GBAORD vs the structural balance, we notice that, apart from the spike in 2011, most likely due to the budgetary cuts linked with the macroeconomic situation of the country, the levels in 2013-2014 are slightly higher than in 2010. In other words, based on Figure 6 the share of GDP devoted to GBAORD did not suffer during the fiscal consolidation. However, institutional funding in HEIs increased from 39.43m in 2010 to €106.42m in 2011. The leap in funding between 2010 and 2012 may possibly be a statistical artefact and refer to change in accounting rules since most of the personnel costs on HEI were reshuffled to the chapter on research. Given that the above mentioned increase of 67 MEUR is of the order of 0.1% of GDP, an eventual downward adjustment of the 2011-2014 GBAORD/government funded GERD figures by this amount may lead us to assumption that public support to R&D has decreased during the post-crisis fiscal consolidation period.

## 3.3 Funding flows

### 3.3.1 Research funders

The MESRS is the main funding body for 20 public higher education institutions. The total block grant for the public HEIs is determined by the State Budget Law, but grants for particular HEIs are distributed via the MESRS. There were 23 public and 13 private HEIs in 2015 in Slovakia. The State Budget Laws set public support to HEIs to €442m in 2014and €449m in 2015 (see chapter 3.4.1 for more details). Share of public expenditure on the university system in GDP was estimated to 0.62% and 0.59% respectively for 2014 and 2015.[21]

The Slovak Academy of Sciences (SAS) is a research body providing bulk of basic research in Slovakia. The SAS has its own chapter in the State Budget Law. Budget allocations are subject to intense negotiations between the SAS and the Ministry of Finance. The 2014 and 2015 State Budget Laws set institutional budget of the SAS to €59.71m and €58.52m respectively. The SAS also benefited from grants €72m provided by the Structural Funds in 2014. The SAS employed 3144 workers in full-time equivalent, of which 1938 researchers and 492 PhD students (source: The 2014 Annual Report of the SAS).

The VEGA is funding grant agency for the MESRS, and the SAS. The VEGA allocated €13.82m to 1934 research grants in 2015 (source: the VEGA webpage). The MESRS manages the Slovak Research and Development Agency (SRDA). The agency mostly provides applied research grants for public and private bodies. The SRDA budget is set in the State Budget Law. It increased from €0.15m in 2001 to €26.27m in 2014. The 2015 SRDA budget is set to €26.16m.

The MESRS also manages the Research Agency (the former Agency for the Structural Funds of the European Union, ASFEU). The Slovak Government amended the agency's statute and credited it with some new tasks in 2015[22].

- 'establishing a functional system for co-ordinating research and development system, and a system of education adapted to needs of economic practice, as to achieve targets set by the RIS3';
- 'supporting thematic specialisation, with regards to the existing research capacities, for the needs of economic practice and societal challenges';
- 'supporting use and development of science and research infrastructures, according to the RIS3 priorities';
- 'creating conditions for participation by the Slovak research teams in the European Research Area in general, and in the ESFRI, EITI, technology platforms and Horizon 2020 in particular';

[21] Estimates of the GDP volumes provided by the AMECO macroeconomic database (European Commission, Economic and Financial Affairs). Source for budget data: Slovak Ministry of Finance (2014) Proposal for the 2015-2017 Budget of Public Administration.

[22] Tasks explicitly stated by the amended statute of the Research Agency of 01.07.2015.

- 'implementing and administering policy measures of the Operational Programme Research and Innovation, as to achieve RIS3 targets'.

The amended statute sets that the representatives of the private sector organisations should appoint half of the Research Agency board. The Research Agency implemented the Operational Programme 'Research and Development' (OPRD) and 'Education' (OPE) in 2007-2015. The RA also implements selected policy measures funded by the Operational Programme Research and Innovation (OPRI) in 2015-2020.

The Ministry of Economy manages the Slovak Innovation and Energy Agency (SIEA). The Slovak Government amended the agency's statute on 30 January 2015. The SIEA's mission is 'conceptual, professional, methodical, co-ordination, information, educational, promotional and other activities in field of technology and innovation, and energy'. The SIEA inter alia 'implements the tasks of the Technology Agency, according to the RIS3 document'. Among the first outputs of this kind, the SIEA mapped the segments of automation, robotics and digital technologies providing thus a detailed picture of these industry segments and a basis for decision making and support tools design.

The SIEA implemented the Operational Programme Competitiveness and Economic Growth (OPCEG) in 2007-2015. The OPCEG 1.1 and 1.3 policy measures were major sources of finance for innovation development in Slovakia (Table 5). The SIEA also implements selected policy measures funded by the OPRI in 2015-2020.On an annual basis, the SIEA organises the Innovative Deed of the Year on behalf of the Ministry of Economy. In 2015 this event which promotes the most innovative enterprises and/or products celebrated its 8$^{th}$ anniversary.

The private non-profit sector accounted for less than 0.1% of total outlays on R&D in 2014. There are no important research charities in the Slovak Republic.

### 3.3.2 Funding sources and funding flows

The total public expenditure on R&D (government + higher education) was about €1,663m in period 2007-2014. The total indicative allocation of the OPRD is €1,422m for period 2007-2013/15. Actual spending by the OPRD was €891.6m in period 2007-2014. The OPRD therefore provided about one third of total public support (national + European) in the abovementioned period in Slovakia. The OPRD has been extremely significant for the project funding. The Eurostat states total national project funding €62.27m in 2012 and 65.65 in 2013 Slovakia. The OPRD indicative annual allocations were 3-4 times higher than those by the national public ones. The FP7 funding was far less important in Slovakia (€78.0m) than in other small European economies (Ireland: €634.4m; Greece: €1012.3m; Finland: €887.4m; Denmark: €1084.6m; Portugal: €526.1m; Czech Republic: €289.3m; Hungary: €293.7m; Slovenia: €171.8m) in period 2007-2014.

**Table 5:** Structural Fund schemes supporting research and innovation projects in Slovakia, as of 31.12.2015

| Operational programme | Policy measure | Total budget, €m | Projects submitted | Assistance required, €m | Contracted projects | Contracted assistance, €m | Certified eligible costs, €m | Certified costs as % of total budget |
|---|---|---|---|---|---|---|---|---|
| OPRD | 1.1 | 146.5 | 189 | 722.1 | 45 | 195.5 | 137.1 | 93.5 |
| OPRD | 2.1 | 112.2 | 139 | 339.5 | 67 | 157.6 | 144.4 | 128.8 |
| OPRD | 2.2 | 371.8 | 537 | 1168.1 | 178 | 559.5 | 445.0 | 119.7 |
| OPRD | 3.1 | 40.6 | 31 | 166.6 | 8 | 55.7 | 46.0 | 114.4 |
| OPRD | 4.1 | 63.2 | 102 | 270.1 | 40 | 93.8 | 82.2 | 130.1 |
| OPRD | 4.2 | 212.2 | 242 | 581.6 | 82 | 288.6 | 233.0 | 109.8 |
| OPRD | 5.1 | 230.4 | 102 | 452.8 | 73 | 294.1 | 266.8 | 115.8 |
| OPCEG | 1.1 | 470.5 | 2,953 | 1,522.6 | 1001 | 509.0 | 387.7 | 82.4 |
| OPCEG | 1.3 | 82.8 | 392 | 354.1 | 82 | 94.4 | 59.8 | 72.3 |
| OPBR | 2.1 | 28.8 | 305 | 45.3 | 200 | 29.0 | 30.02 | 104.1 |
| OPE | 1.2 | 113.2 | 202 | 214.5 | 117 | 120.7 | 75.6 | 66.8 |

Source: Central Co-ordination Office of the Slovak Government: National Strategic Reference Framework; Funds Allocation and Lists of Projects. Notes:

OPRD = Operational Programme Research & Development. Policy measures: 1.1 Reconstructing and building technical infrastructure of R&D; 2.1 Support to networks of centres of excellence; 2.2 Transfer of knowledge and technologies from R&D into practice; 3.1 Reconstructing and building technical infrastructure of R&D in the Bratislava Region; 4.1 Support to networks of centres of excellence in the Bratislava Region; 4.2 Transfer of knowledge and technologies from R&D into practice in the Bratislava Region; 5.1 Infrastructure of higher education institutions.

OPIS = Operational Programme Information of Society. Policy measures: 1.1 Electronisation of public administration and development of electronic services on the central level; 1.2 Electronisation of public administration and development of electronic services on the local and regional level; 2.1 Improvement of the system of acquisition, processing and protection of content from the resources of repository institutions; 3.1 Development of broadband access infrastructure.

OPCEG = Operational Programme Competitiveness and Economic Growth. Policy measures: 1.1 Innovation and technology transfers; 1.3 Support of innovation activities in enterprises.

OPBR = Operational Programme Bratislava Region. Policy measures: 2.1 Innovations and Technological Transfers;

English titles of policy measures as stated in official documents. All budgets include the EU and national resources. Information on spending by the JEREMIE initiative (supported from the Operational Programme Research and Development) was not available.

The OPRD coped with significant problems in absorption capacity. First OPRD calls were launched in 2008. Only some 45.7% OPRD resources were spent by end of 2013. The Slovak Republic was allowed to prolong the programme spending till 2015.

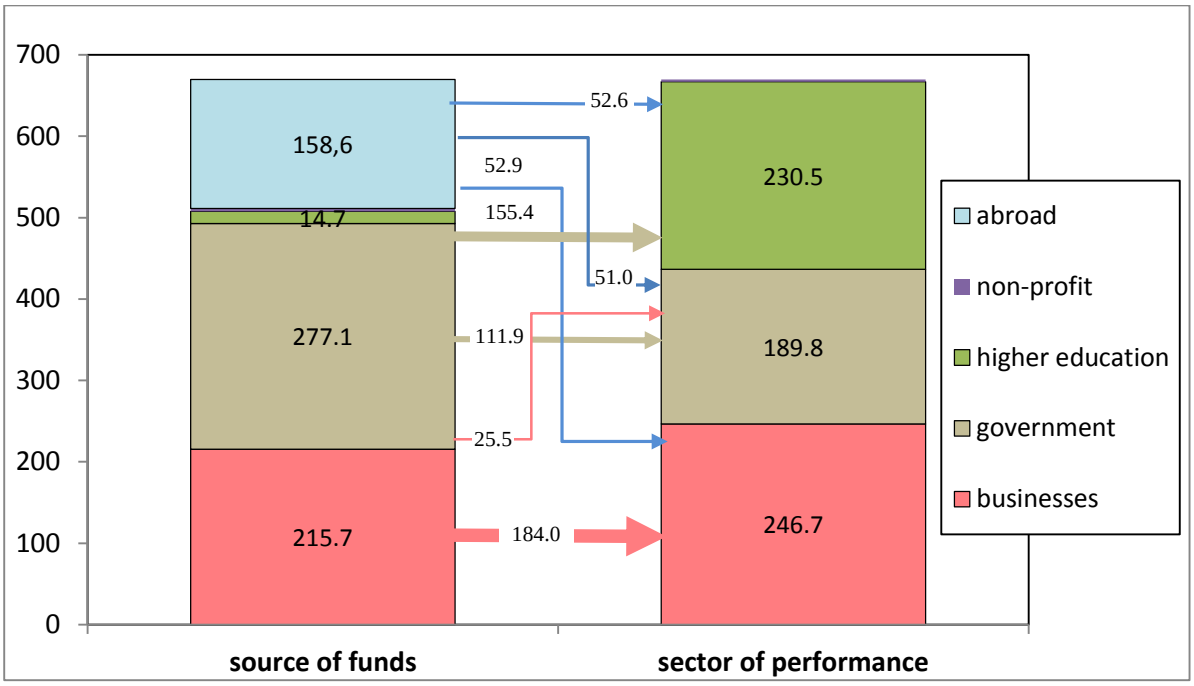
The Slovak economy was dominated by the multinational enterprises (MNE). The latest available data by the Eurostat indicate the foreign controlled enterprises generated 38.2% of the total value added in Slovakia in 2011. The intra-mural BERD in foreign controlled enterprises accounted for 77.9% of the total intra-mural BERD in the same year in Slovakia.

Figure 7 displays principal flows on the Slovak R&D system by source of funds and sector of performance in 2014. The structure of flows points to isolation of the government and higher education sectors on one hand and business sector on the other hand. Three major flows (businesses → businesses; government → SAS; and government → HEIs) accounted for 67.5% of all flows in 2014 (€666.6m). The interconnection between the business sector and the higher education and government sector is quite low. Flows from the business to government and business to higher education sectors (€25.5m + €5.6m)

accounted for 3.2% of all flows in 2014. It means that research financed by the business sector primarily is performed in the business sector. The Slovak businesses rarely commission their research in the HEIs and/or the SAS. Research performed by the SAS and HEIs primarily was financed by the government and resources from abroad (the European Commission in particular).

A significant increase in the business expenditure on R&D would require schemes aimed at co-operation between the business and public sectors. The planned OPRI call under Target 2.1.1 'Mobilising excellent research teams in area of RIS3 in the Bratislava Region', for example, targets 'increasing R&I activity via revitalisation, research, education, innovation, and business-oriented capacities of the research institutions in the Bratislava Region'. Measures supporting R&D co-operation by public and business sector are also contained in Goal 1 of the RIS3 document (see chapter 2.1). The public R&D institutions depend on the State Budget resources. They have limited own sources of funds for R&D performance. Support to R&D by the national public and European resources should multiply business expenditure on R&D. It also should provide for a better use of the large research infrastructures completed by end of 2015.

**Figure 7** Main financial flows in the Slovak R&D system (€m, 2014)




Sources: Eurostat (2015): Gross Expenditure on Research and Development by Source of Funds and Sector of Performance, and authors' computations.

The Eurostat data on the direct investment positions indicate that Slovakia accumulated €3m of foreign direct investment (FDI) in R&D sector by 2011 and €1m by 2012 (latest available data). The stock of the R&D investment was considerably lower in Slovakia than that in Hungary (€73m) and the Czech Republic (€47m) in 2012.

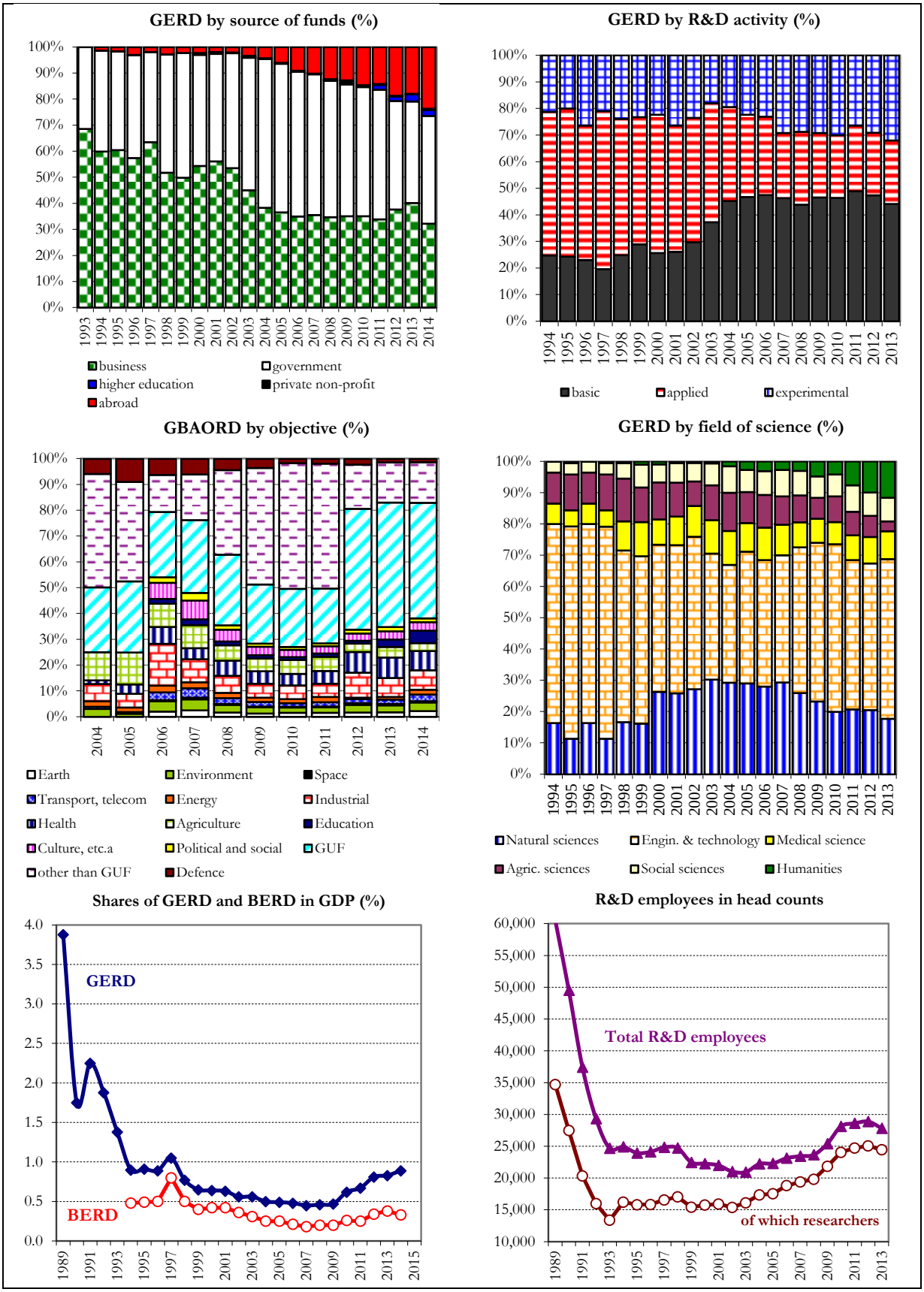



**Figure 8** RTDI trends in Slovakia. Sources: Eurostat and the Statistical Office of the Slovak Republic

## 3.4 Public funding for public R&I

### 3.4.1 Project vs. institutional allocation of public funding

The Smart Specialisation Strategy for Slovakia (RIS3 document) foresaw some far-reaching legislative reforms for the Slovak national system of research and innovation: reform of higher education, reform of the research funders and reform of the SAS. Reforms of higher education and research funders did not even start. Reform of the SAS failed in 2015 (see chapter 2.1 for more details).

The Eurostat data on GBAORD by funding mode set public finance for project funding to €62.72m in 2012 and €65.65m in 2013 (21.3% and 22.7% of total public support respectively). These values are somewhat higher than sums provided by the major research funders, R&D tax incentives, sectoral ministries and budget for the international co-operation in R&D (Table 6).

Looking at the Eurostat and national data, the balance between institutional and project funding changed little in the last three years. The balance between competitively (performance based) and non-competitively (block funding) allocated institutional funding also changed little in the last three years. Block grants for the HEIs and the SAS, as well as budgets of the national funding agencies remained about the same in period 2012-2015.

**Table 6:** Major national project finance schemes in Slovakia (€m)

| | **2012** | **2013** | **2014** | **2015** |
|---|---|---|---|---|
| SRDA budget | 22.99 | 25.96 | 24.96 | 26.16 |
| VEGA grants | 13.34 | 13.56 | 13.77 | 13.82 |
| KEGA grants | 2.49 | 2.49 | 2.50 | 2.50 |
| R&D tax incentives | 7.51 | 3.92 | 2.94 | 1.87 |
| Int. co-operation in R&D | 10.85 | 11.01 | 9.10 | n.a |
| sectoral ministries | 3.25 | 3.21 | 3.14 | n.a |
| total | 60.43 | 60.16 | 56.41 | n.a. |
| Eurostat | 62.72 | 65.65 | n.a | n.a |

Sources: author's own computations from data provided by the MESRS

Competitive institutional funding supports running costs of public institutions and excludes salaries and/or capital expenditure. The competitive institutional funding from national resources is provided via the Vedecká grantová agentúra (VEGA), and the Kultúrna a edukačná grantová agentúra (KEGA) grants. The VEGA and KEGA grants help paying for the overhead costs of research institutions. The HEIs part of the VEGA funded 1275 projects (€9.40m) and the SAS part of the VEGA 659 projects (€4.42m) in 2015. The KEGA funded 417 projects in Slovak HEIs (€2.50m) in 2015. The VEGA and KEGA grant applications are reviewed by three referees, one of whom should be from abroad. The VEGA and KEGA grants generate minor shares in the total institutional funding for the HEIs and SAS (2.7% and 7.5% respectively in 2015). Budgets of the VEGA and KEGA agencies remained almost unchanged in nominal terms in last ten years. No review of the funding efficiency be the abovementioned agencies in available.

### 3.4.2 Institutional funding

The institutional funding is, in theory, allocated on institutional assessment and quality related criteria. In fact, the institutional funding reflects work entitlements, demands on mass education and ability of the HEIs and SAS to negotiate their budgets with the Ministry of Finance.

The total block grant for the public HEIs is determined by the State Budget Law, but grants for particular HEIs are distributed via the Slovak Ministry of Education, Science, Research and Sports (MESRS). The 2016 annual block funding includes four major components: (a) support to accredited study programmes (teaching, €245.5m); (b) support to R&D and art activities (€148.0m); (c) support to development of HEI (€1.5m); (d) support to students from low-income families (€56.2m). Components (a) and (b) are of prime interest by HEIs. Support to development of HEI (component 'c') is low and considered case by case. The component 'd' directly is given to students. The MESRS uses complex formulas for allocating institutional support (components 'a' and 'b') to 23 public HEIs[23]. The setup of the institutional support to HEIs favours HEIs with high numbers of students and results of the past evaluation. Three items: (1) Numbers of students; (2) R&D quality of a HEI (as established by last accreditation) and (3) publications generated 83% of the HEIs income in components (a) and (b) in 2015:

- Component (a): The 2016 formula for wages in HEIs gives 85% weight to the number of students and a 15% weight to research/arts[24] output by particular HEIs. Wages (€181.1m) generated bulk of support to accredited study programmes in 2016.
- Component (b): Wages (€135.7m) generate bulk of support to HEIs' R&D and art activities. The 2016 formula for wages in 'R&D and art activities' gives a 43% weight to R&D quality of a HEI (as established by last accreditation), a 22.5% weight to the share of a HEI in the national research/arts output, a 10% weight to the share of a HEI in the national number of PhD students, a 12% weight to the share of a HEI in domestic grants, a 10% weight to the share of a HEI in foreign grants and 2.5% is determined by HEIs share in total domestic art output.

### 3.4.3 Project funding

The national and European resources provide project funding for research in Slovakia. Slovakia has no national research programmes. The last State Research and Development Programmes expired in 2010.

Vast majority of the project finance is supported from the Structural Funds in Slovakia (see Table 5 for more details). The Eurostat data on the GBAORD by the funding mode do not state European support to R&D in Slovakia. Comprehensive data on annual disbursements for R&D by the Structural Funds are not published in Slovakia. Differences in spending rates by the OPRD in 2014/2013 (62.7% / 45.7%) indicate that the OPRD spent about €241.9m in 2014. The OPRD spending was about four times higher than that by the national project finance. The OPRD unfortunately accounted for no thematic focus. It also mentioned no societal challenges.

The Structural Funds and the Cohesion Fund provided 43.2% of total public funds for research and development in 2008-2014 in the Slovak Republic. Public resources generated some 60% of total gross expenditure on research and development (GERD), and the rest was provided by the private sector in the abovementioned period. Most support from the Structural and Cohesion Funds targeted public sector in general and large research infrastructures in particular. As for the private sector, the SF and CF provided about one third of total resources for business expenditure on research and development. The rest was provided by the businesses (see 'Contribution to the EU 2020 – Research and Development' for more details).

There is no exact data on the balance between the funding of projects and individual (person bound) grants. The OPRD, however, focused on infrastructure building projects (R&D centres, science and technology parks). Individual grants likely were quite an unimportant target of support.

---

[23] MESRS (2015): Rozpis dotácií zo štátneho rozpočtu verejným vysokým školám na rok 2016 {*The state budget grants for public higher education institutions in 2016*}.

[24] Arts outputs are considered for the HEIs specialised in music, drama and arts.

The MESRS regularly publishes the Annual Report on R&D. The reports summarise data on the state financial support to R&D. They also briefly mention main schemes financed from the European resources. Last editions of the report also include output indicators for selected project schemes, in terms of publications, patents, and international research exchange. The MESRS and the Ministry of Economy also draft annual reports on the OPRD and OPCEG. The reports focus on administrative issues (compliance of project beneficiaries with formal rules, absorption capacity), but provide little insights in economic and social impacts by the abovementioned operational programmes. In 2015 the Slovak Government commissioned the Pilot Evaluation of the Structural Funds' contribution to key targets of the Europe 2020 strategy in 2015 (see chapter 2 for more details).

The RIS3 document contains list of thematic priorities and (rather loose) references to the societal challenges for period 2014-2020. The Operational Programme Research and Innovation (OPRI) provides bulk of finance for implementation of the RIS3 goals.

All competitive funding is subject to peer review in Slovakia. The Slovak Research and Development Agency (SRDA) grants are reviewed by domestic and foreign peers. One peer is a member of the SRDA advisory panel for particular field of science, one a domestic expert and one a foreign researcher. The publications and citations in peer reviewed journals are usual evaluation criteria. The Structural Fund projects allocate hundreds million euros (sometimes €10-20m per project, see Table 5), but have been evaluated by domestic evaluators only in 2017 - 2013/15.

### 3.4.4 Other allocation mechanism

The State Budget supported six horizontal and three thematic State Research and Development Programmes (SRDPs) in period between 2003 and 2010. Total state budget provided €91.36m and the private sector €20.94m to SRDPs in the abovementioned period. The State Research Orders (SRO) for public research organisation was another allocation mechanism used prior to 2010. No SRDP and SRO were launched since 2010.

## 3.5 Public funding for private R&I

### 3.5.1 Direct funding for private R&I

The vast majority of direct funding for private R&I in Slovakia has been provided by Structural Funds. Bulk of funding has been disbursed via the OPRD and OPCEG in the period 2007-2013/15.

The OPRD and OPCEG lacked clear thematic priorities and addressed no societal challenges. Thematic priorities and social challenges are far better articulated in the Smart Specialisation Strategy (RIS3 document) for period 2014-2020. The Operational Programme Research and innovation (OPRI) is major source of finance for implementation of the RIS3 goals.

Funding streams by the OPRD and OPCEG covered the entire R&DI process from fundamental research to market innovation. The OPRD 2.1/4.1 policy measures, for example, supported excellent basic and applied research in public research organisations and HEIs (see Table 5 for more details). The OPRD 2.2/4.2 Policy Measures aimed at 'Increase the level of cooperation of R&D institutions with the society and economy through the transfer of knowledge and technology, thereby facilitating economic growth of the regions and of the whole Slovakia'.

The total indicative budget of the abovementioned policy measures were €460.96m and €271.89m respectively. The policy measures intervened in two areas: (a) developing platforms for co-operation by private and public sectors; and (b) establishing large-scale research infrastructures for knowledge transfer. The measures supported 20 calls for creation of 98 R&D Centres and eight Competence Centres in 2008-2011. The measure also funded five calls for University Science Parks in the Bratislava Region (€224.74m)

and five mirror calls in the non-Bratislava regions (€336.46m) from June 2012 to October 2013. All these projects finished in December 2015.

The OPCEG 1.3 Policy Measure aimed at 'increasing the competitiveness of industry through supporting innovation activities and the related applied research in businesses, i.e., through supporting the introduction of new innovations for technologies, procedures, or products'. The policy measure had indicative budget €106.3m and actually supported 83 companies with €52.1m by October 2015. The abovementioned policy measures coped with considerable administrative burden. The burden favoured medium-sized and large companies. These companies could afford hiring specialised consulting agencies for paperwork and reporting activities. There were no support schemes for start-ups in the OPRD and OPCEG. Support schemes for start-ups are envisaged by the OPRI for period 2014-2020. First calls are expected in 2016.

The OPRD and OPCEG annual reports provide for formal evaluation of the support schemes. The evaluation mostly concentrates on number of supported projects and amount of financial support disbursed. The annual reports also summarise information on selected output indicators (increase in value added, intellectual property rights, jobs created, etc.). Funding schemes are never benchmarked against comparable schemes in other countries.

The Slovak Government commissioned the 'Pilot project– contribution to the EU 2020 targets in research and development'. The project, inter alia, compered planned / actual values of (a) co-operation research projects with the public and private organisations (601 / 25); (b) work moves generated via co-operation by the public (SAS, HEI) and business sectors (14 / 0); (c) new jobs created (247 / 72), and (d) patent applications (60 / 14) by end of 2014. Poor planning, lacking administrative support to private sector applicants and high administrative burden showed in low absorption capacity by the Structural Funds[25]. Some 82.4% and 63.0% of the OPRD and OPCEG budgets were spent by October 2015.

Slovakia has no national target for public procurement of innovative goods and services. Most public procurement related to development of the e-government services and was financed from the Operational Programme Information Society (OPIS). The OPIS projects accounted for mixed success (see the 2014 Country Report for more details). The OPIS coped with low absorption capacity. Some 74.5% of the programme budget was spent by July 2015. The 2013 European Public Sector Innovation Scoreboard gave Slovakia low marks in most components of the Public Innovation Scoreboard. The 2014-15 Global Competitiveness Report of the World Economic Forum ranked Slovakia no 117 in the 'Government procurement of advanced technology products' in the World league of 143 countries.

Technology support to consistent use of the public procurement is a relatively recent phenomenon in Slovakia. The Electronic Contract System (ECS), for example, was introduced as late as in 2015. All public bodies must use the ECS for purchases of goods and services over €1000. Introduction of the ECS has been motived by the cost-cutting, rather than procurement of innovative technologies.

The innovative public procurement has not been actively used to improve public services. Slovakia has neither national target nor strategic framework for public procurement of innovative goods and services. There also is no national coordinating service offering support to contracting authorities and raising awareness on innovation procurement.

[25] National Audit Office (2012): Správa o výsledku kontroly čerpania prostriedkov štrukturálnych fondov v rámci operačného programu Výskum a vývoj {*Report on results of audit of expenditure by the Operational Programme Research and Development*}.

Most public procurement related to development of the e-government services and was financed from the Operational Programme Information Society (OPIS). The OPIS projects coped with slow implementation and poor management. Many e-government services failed (e-health, and fiscal system in particular; see the 2014 Country Report for more details). The OPIS also coped with low absorption capacity. Some 74.5% of the programme budget was spent by July 2015.

### 3.5.2 Public Procurement of Innovative solutions

The estimate of the total public procurement expenditure in the Slovak Republic in 2014 was €6.9b, equal to 9,35% of GDP[26].[27]

Legal Public Procurement framework

Public procurement in Slovakia is regulated by the act No. 343/2015 Coll., effective as of 18 April 2016, which replaces the Act No. 25/2006, as well as a number of decrees, part of which transpose the relevant European legislation.

Until 17 April 2016 (during 2015), the standard national threshold for the publication of public procurement in Slovakia was set at:

- €1,000 for supply /service/ building works (commonly available on the market) contracts - there is an obligation to use electronic contracting system (ECS) – central trading place;
- € 20,000 for supply /service (not commonly available on the market) contracts - usage of ECS or Slovak Official Journal;
- €30,000 for supply building works (not commonly available on the market) contracts - usage of ECS or Slovak Official Journal.

With the new law, effective as of 18 April 2016, the standard national threshold for the publication of public procurement in Slovakia is set at:

- €5,000 for supply /service/ building works contracts for commonly available on the market - there is an obligation to use electronic contracting system (ECS) – central trading place;
- €70,000 for building works contracts not commonly available on the market;
- -€20,000 for supply /service contracts not commonly available on the market.

The Office for Public Procurement is responsible for collecting information regarding public procurement. Since April 2011, the amendment No. 58/2011 to the Act instructs that all public procurement notices are sent to the Office for Public Procurement to be published. According to Article 9(7), introduced by amendment No. 58/2011, contracting authorities are obliged to send copies of tender documentation without delay as soon as a public contract has been concluded. Since January 2011, the amendment 546/2010 to the Civil Code, the Commercial Code and the Act on access to information instructs that all public contracts from that date enter into force only after their official publication on the web page of the contracting authority itself or the Central Register of Contracts.[28]

**PCP/PPI landscape**

The 2013 European Public Sector Innovation Scoreboard gave Slovakia low marks in most components of the Public Innovation Scoreboard. The 2014-2015 Global Competitiveness Report by the World Economic Forum ranked Slovakia no 117 in the 'Government procurement of advanced technology products' in the World league of 143 countries.[29]

---

[26] 2014, European Commission, DG Internal Market study: http://ec.europa.eu/internal_market/publicprocurement/docs/modernising_rules/20141105-indicators-2012_en.pdf.
[27] https://www.uvo.gov.sk/informacny-servis/koncepcia-rozvoja-verejneho-obstaravania-v-sr-426.html
[28] Central Register of Contracts.: https://www.crz.gov.sk/index.php?ID=114372
[29] Ibid.

The Slovak Government passed the 546/2010 Law which sets out that all contracts and purchases made by departments and agencies of the central, regional and local governments must be published on the internet not later than 10 days after the purchase. However, contracts are treated differently. Without a publication, a contract will never become effective. If a contract is not published within 3 months it is considered "not concluded". Information on financial transactions must be also published in a structured way and enable an easy identification of the relevant actors and the expenditures involved. The Central Register of Contracts works well and helps increasing the transparency of public procurement in Slovakia.

The Operational Programme Research and Innovation (OPRI, major source of finance for the Slovak research and innovation system in 2014-2020) makes no special provision for the public procurement of innovative technologies. The OPRI only briefly mentions that 'the state aid schemes would prioritise the procurement of top-notch technologies according to the RIS3 goals'.

The lack of clear national policies and targets for the public procurement of innovative goods and services, and excessive reliance on the EU resources has an impact on the efficiency of innovative public procurement in the Slovak Republic. However, a project for the support of PPIs and PCPs is currently being prepared and its activities should start late in 2016.

**PCP/PPI initiatives**

Examples of innovative public procurement include:

- **The infrastructure for research and development**: The basic idea of the measure is that public sector should build an efficient ICT infrastructure for R&D in the period 2009-2013. The infrastructure should be able to store and provide data for R&D workers with a high degree of availability and security. Fast and reliable broadband networks, solutions for efficient information use and processing, and Intranet and Internet solutions are also parts of the ICT infrastructure.
- **The Electronic Identity Card project (eID**): The project enabled the issuance of ID cards with built-in chips from December 2013. By June 2014 some 281,000 eID cards were issued. The government guaranteed the low price of the eID card (€4.50), and ensured the free distribution of card readers and respective software solutions. About one half of the eID card holders opted for the activation of digital signature. The digital signature simplifies dealings with many public administration services.
- **The e-Health project:** The project was approved via Slovak Government Resolution No 497/2008 of 16 July 2008. Deliverance of outputs was redefined into three phases:
  - Phase 1 (2011 – 2012): "Implementation of basic e-Health functionalities leading to operation financing and implementation of necessary assumptions for setting functionalities bringing benefits for citizens in the shortest possible time ('quick-wins')".
  - Phase 2 (2012 – 2013): "Implementation of functionalities bringing mainly qualitative benefits for the Slovak citizens".
  - Phase 3 (2014 – 2016): "Improvement in preventive care and implementation of personalized medicine through the newest technologies, helping citizens to take care on their health in more efficient and targeted ways".[30]

### 3.5.3 Indirect financial support for private R&I

The indirect support to private R&D was introduced in two phases in Slovakia. The Slovak Parliament passed the 185/2009 Act on R&D Tax incentives. The tax incentives

[30] This project has not been implemented yet.

have been provided via subsidies and the tax reliefs. Subsidies accounted for 87.9% of total tax incentives (€18.42m) awarded to 21 companies in period 2011-2013. The MESRS awarded six companies with tax incentives €8.47m for period 2014-2016[31]. The tax incentives programme had two drawbacks. All tax incentives were subject to approval by the MESRS. The tax incentives were awarded for specific thematic areas only (set by the Danube Strategy). The business community demanded flat and non-discriminatory indirect support to business research. The Slovak Government argued about risks of tax evasion.

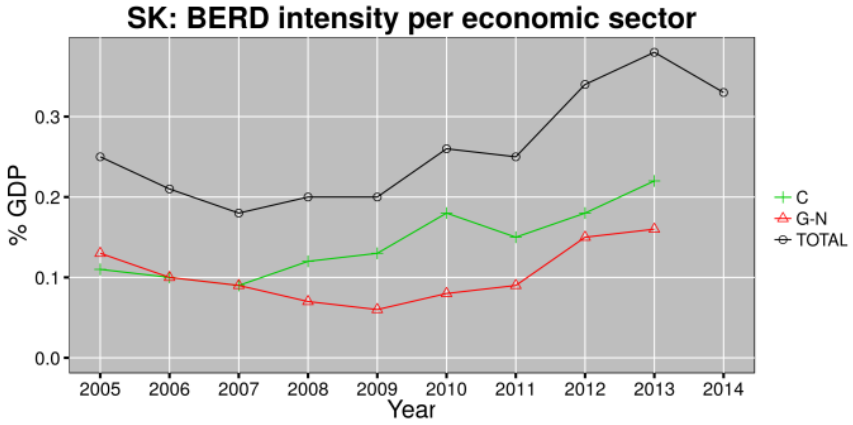
The start-up policies were in embryonic stage in Slovakia. The Slovak Government published first 'Concept paper for the support of start-ups and the development of the start-up ecosystem' as late as in June 2015. See chapter 5.2 for more details.

## 3.6 Business R&D

### 3.6.1 The development in business R&D intensity

BERD intensity in the Slovak Republic is very low. In 2014 it was 0.33%, which is the one of the lowest among the countries that joined the EU since 2004. As a general tendency, it has been growing since 2007, although at a very moderate pace (overall growth of 0.1% of GDP between 2007 and 2014) and with a minor setback in 2014. Manufacturing and services account for more than 95% of the BERD expenditure in the period under scrutiny. The aforementioned growth of the total BERD intensity from 2007 is the result of their combined development along that period. Since 2007, manufacturing has been more BERD intensive than services, but the gap reduced in the recent years.

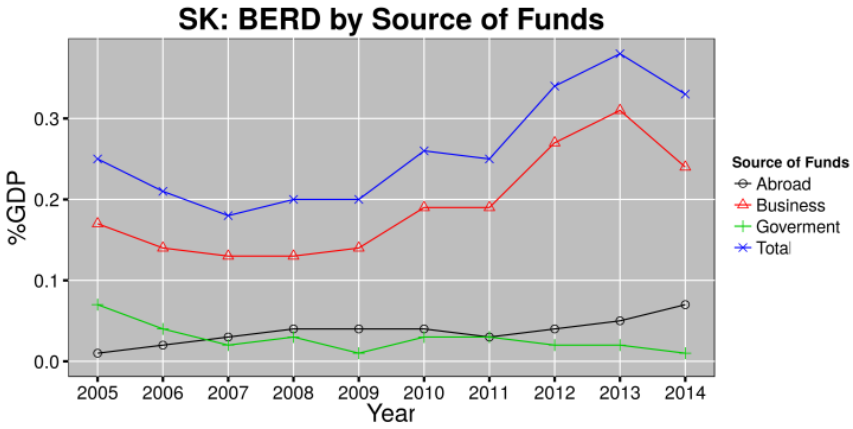
**Figure 9** BERD intensity broken down by most important macro sectors (C= manufacture, G_N=services).




Businesses are the main funders of the Slovak BERD. Funding coming from business grew significantly in 2011-13. External funding (Abroad) has become somewhat more important since 2011. Government funding was less important in general and it has been on a decreasing path since 2010. The Eurostat data on GERD by source of finance indicate that the rise in BERD by domestically-owned firms was more important than the rise in BERD by foreign firms in the Slovak Republic.

[31] Details on mode of aid (subsidies versus tax reliefs) were not available.

**Figure 10** BERD by source of funds




## 3.6.2 The development in business R&D intensity by sector

In terms of sectorial distribution, the automotive sector (manufacture of motor vehicles) is one of the leading manufacture sectors in the Slovak Republic. On Figure 9, we notice a stable growth of its BERD since 2005 and spike in 2013. The other two more important sectors are manufacture of machinery and equipment and manufacture of electrical equipment. While the latter had a generally increasing but rather fluctuating trend up until 2010 and has been stagnating or slightly decreasing ever since, the former shows a steady growth since 2009, practically doubling in 2009-13 after its stagnation beforehand.

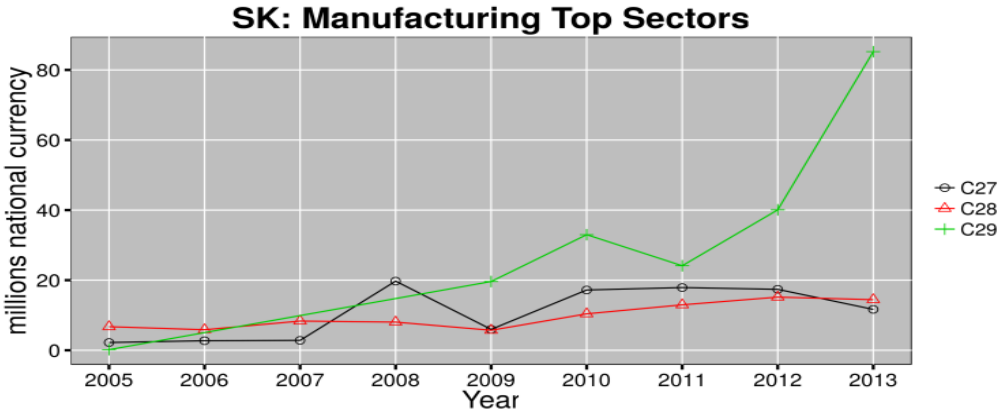
The multinational companies are highly important for employment, added value and exports in Slovakia. R&D intensive FDI is also a part of the Slovak Investment Aid Act, which provides a legal framework for investment incentives into R&D related, so called „Technology Centres". Institutions such as the Slovak Investment and Trade Development Agency (SARIO) also acknowledge the importance and socio-economic aspect of R&D intensive FDI and provide more detailed services to such investors. The automotive industry, consumer electronics, financial services and information and communication services were prime targets for the FDI in Slovakia. SARIO's webpage promotes several advantages of the R&D intensive FDI (the R&D Tax incentives Act, tax deductions). It also mentions several 'success stories' and lists multinational companies investing in the Slovak Republic (Johnson Controls, ON Semiconductor, Leoni, BSH, ThermoSolar, Sauer Danfoss, Krauss Maffei, Ness, Siemens, Alcatel-Lucent, Mühlbauer, Continental Automotive Systems etc.). On demand, it can also provide selected information regarding R&D intensive FDI in the country.

Data on private research funding in the Slovak Republic are quite scarce. No Slovak company was included in the 2011, 2012 2013 and 2014 EU Industrial R&D Investment Scoreboard.[32] Annual reports of several companies provide limited and uncategorised data on R&D spending – Continental Matador Rubber (automotive parts): €21.452m (2013), US Steel: €3.1m (2014), Biotika (pharma) €2.456m (2014), Slovak Power: €2.0m (2014) and Slovnaft (oil processing): €0.488m (2014).

[32] http://iri.jrc.ec.europa.eu/scoreboard14.html

**Figure 11** top sectors in manufacturing

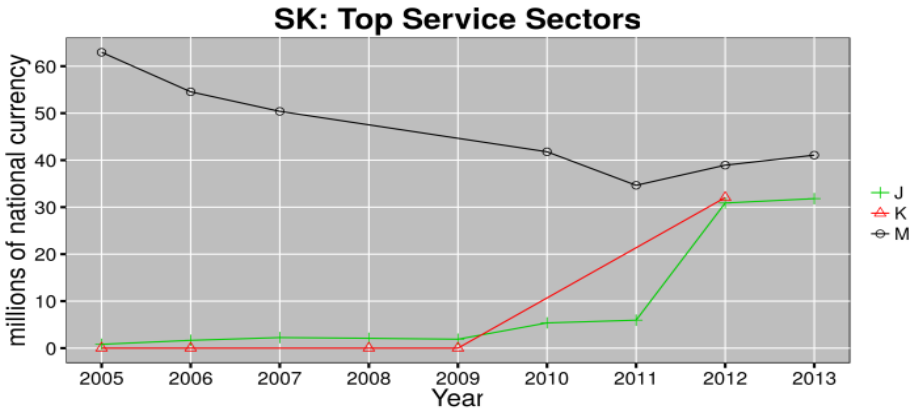
(C27=manufacture of electrical equipment; C28= manufacture of machinery and equipment C29=manufacture of motor vehicles, trailers and semi-trailers)




In the services sector the main contributors to business R&D are professional and scientific services, information and communication services as well as financial and insurance services (Figure 12). Business R&D expenditures in the first category faced a steady decline hitting its bottom of €35m in 2011. After this it grew moderately by 5 MEUR in the following two years. Trends are opposite in the other two categories (information and communication and financial services BERD). They were practically non-existent until 2009 when a strong growth followed in both cases reaching the nowadays (2012/13) level of€35m.

**Figure 12** top service sectors

(J=information and communication, K= Financial and insurance activities, M=professional, scientific and technical activities)



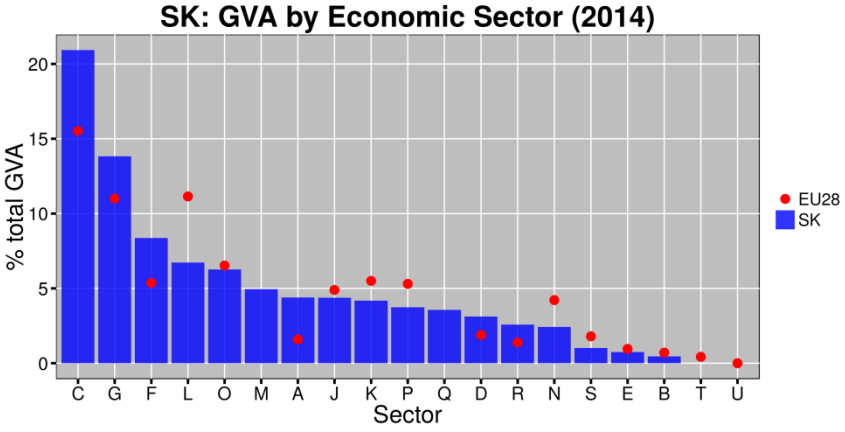

### 3.6.3 The development in business R&D intensity and value added

When looking at the contribution of the various sectors to the total gross value added (GVA), we notice that manufacturing, and services in wholesale and retail trade play a leading role. Construction, real estate activities and public administration are also somewhat important sectors in terms of GVA (Figure 13).

Comparing Figure 12 and Figure 13, we observe that services sectors that tend to receive more BERD are contributing to somewhat less extent to the GVA. One explanation could be that these are typically smaller sectors within the country's economy.

**Figure 13** economic sectors as percentage of the total GVA.

Top 6 sectors in decreasing order: 1) manufacture, 2) wholesale and retail trade, 3) construction, 4) real estate activities, 5) Public administration and defence, 6) transportation and storage




According to Figure 14, below, the automotive industry (manufacture of motor vehicles, trailers and semitrailers) appears to be the leading manufacture sector in terms of GVA. This is consistent with its importance in the manufacturing sector BERD. Although tending to become more important in terms of BERD, the share in GVA of electrical equipment as well as of machinery and equipment manufacturing has a lower share in GVA than manufacturing.

**Figure 14** GVA in manufacturing.

Top 6 manufacturing sectors: 1) motor vehicles, trailers and semi-trailers, 2) fabricated metal products except machinery and equipment, 3) food products, beverage and tobacco products, 4) machinery and equipment, 5) rubber and plastic products, 6)basic metals

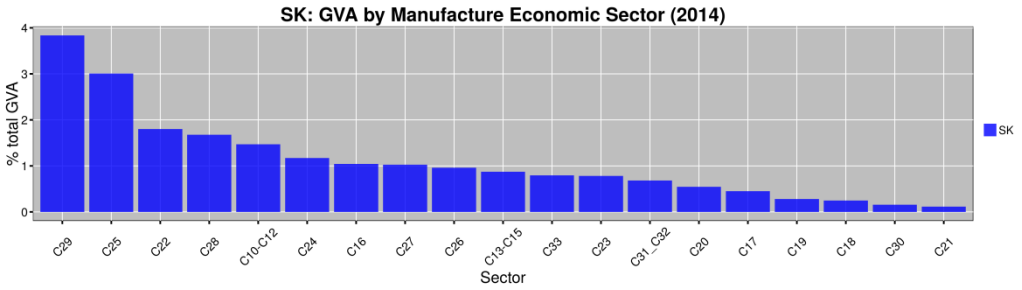
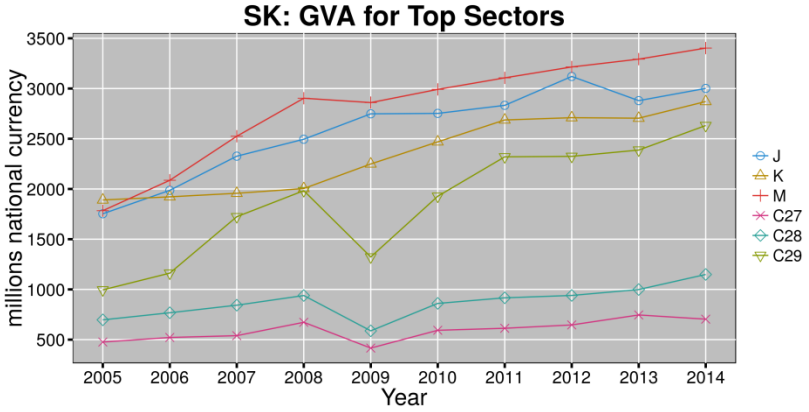



Figure 15 shows the GVA contribution of the most BERD intensive service and manufacture sectors. We observe that the professional, scientific and technical activities sector was the main contributor to VA throughout 2005-2012. This is followed by medium technology sectors managing to attain rapid growth levels. These are: the automotive industry (C29), information communication services (J), as well as financial services (K). Machinery and equipment (C28) as well as electrical equipment (C27) sectors have not managed to increase their share in VA at factor costs throughout the analysed period.

**Figure 15** Gross value added (GVA) top sectors




## 3.7 Assessment

The major challenges relevant for the efficient and effective functioning of the funding allocation system include (a) the lack of a stable and predictable budgetary framework for R&D; (b) an underdeveloped evaluation culture, and (c) no clear relation between the results of evaluations and the amount of funding (see chapters 1.2.2 and 2.2.1 for more details).

The institutional support to the HEIs and the SAS remained about the same in nominal terms and decreased in real ones (share of GBAORD in GDP dropped from 0.46% to 0.39% in period 2011-2014). Low institutional funding was reflected in sub/optimal performance of public research bodies. Top Slovak public research performers (SAS, the Comenius University in Bratislava and the Slovak University of Technology) significantly lagged behind their counterparts in the Czech Republic and Hungary. As for the 2014 SCIMAGO institutional ranking indicators, Slovak research bodies achieved ranks several hundred places lower than the top HEIS and academies of science in the Czech Republic and Hungary. The top Slovak HEIs and the SAS also have been sliding down in the Webometrics and Scimago rankings since 2009.

The block funding criteria in the HEIs provide perverse incentives for suboptimal research performance. The criteria promote mass education, and production of substandard research outputs. Any HEI, under current criteria, makes little profit from a paper in good international journal. A better strategy is to concentrate on high numbers of low-quality publications. The SAS budget has never been related to excellent research outputs. It rather reflected ability of the SAS to mobilise public opinion and negotiate with the Ministry of Finance.

Budgets of the national funding agencies (VEGA, KEGA, SRDA) changed little in nominal terms and decreased in real ones in last ten years. Since 2010 Slovakia had no national research programmes. The Slovak Government pointed to abundance of resources provided by the Structural Funds. The OPRD provided significant resources for building research infrastructures. The OPRD projects accounted for high success rates, but generated significant administrative burden for the project beneficiaries. Most public research institutions and HEIs concentrated on the OPRD projects and skipped FP7 applications. Consequently, Slovakia ranked to the poorest FP7 performers. The Slovak Republic obtained 0.3% of the total EU contribution in FP6, 0.2% in the FP7 and 0.1% in the H2020 programme by 2015. The OPRD resources had a negative effect on demand for excellence-based funding.

Direct support to R&I performers is main type of finance in the Slovak R&I system. Tax incentives were introduced as late as in 2015. It is too early to assess their contribution to R&I system.

Reforms of the higher education, SAS and research funders (laid down by the RIS3) have been slow.

The Slovak Government prepared three drafts of the Action Plan for the RIS3 Strategy in 2014-2020. No Action Plan was approved by end of 2015.

The RIS3 document envisaged merging eight funding agencies to two. The Slovak Government did not merge agencies for R&I funding in 2015. The government rather renamed incumbent agencies and credit them with some new tasks. Total number of funders did not change in the last three years.

The first calls from the OPRI started in 2016. Some calls are designed for Slovak participants only. Some calls are open for research institutions based in other EU Member Countries. This is a noel and positive development compared to the programming period 2014-2020.

# 4. Quality of science base and priorities of the European Research Area

## 4.1 Quality of the science base

The Slovak Republic underperformed in most publication indicators compared to the EU28 average in 2013 (Table 7):

- Slovakia produced 1.13 publications per thousand population (EU28: 1.43, CZ: 1.73, HU: 0.92);
- International co-publications accounted for 37.4% of all publications in Slovakia (EU28: 36.4%; CZ: 37.6%; HU: 47.1%);
- Slovakia had 5.73% of its total publications among the top 10% most cited publications (EU28: 11.29%; CZ: 7.34%; HU: 7.83%);
- Public-private co-publications accounted for 0.7% of all publications in Slovakia (EU28: 1.8%; CZ: 1.0%; HU: 1.3%).

The 2014 Innovation Union Scoreboard indicated that Slovakia produced just 15.7 public-private co-publications per million population in 2011 (EU28: 52.8; CZ: 33.7; HU: 31.2). Low numbers of public-private co-publications refer to low co-operation by public and private research sectors in Slovakia (see chapter 3.3.2 for more details).

There also were some positive developments in publication activity in Slovakia. Share of publications among the top 10% most cited publications rose from 3.61% in 2000 to 7.51% in 2010.

**Table 7:** Main publication indicators

| Indicator | **Slovakia (2013)** | **EU average (2013)** |
|---|---|---|
| Number of publications per thousand of population | 1.13 | 1.43 |
| Share of international co-publications | 37.4% | 36.4% |
| Number of international publications per thousand of population | 0.42 | 0.52 |
| Percentage of publications in the top 10% most cited publications | 5.73 (a) | 11.29 (a) |
| Share of public-private co-publications | 0.7% (b) | 1.8% b |

Notes: (a) Average for 2000-2013; (b) average for 2011-2013

## 4.2 Optimal transnational co-operation and competition

### 4.2.1 Joint programming, research agendas and calls

The Eurostat data on the national public funding to transnationally co-ordinated R&D indicate Slovakia spent €6.6m for the joint research agendas in 2014 (the Czech Republic €38.3m, Hungary €7.8m in the same year). The amount of funding is scarce to integrate the Slovak science into European and international co-operation networks.

The Slovak research policies lacked clear focus on the joint research agendas addressing grand challenges and joint programming. The Smart Specialisation Strategy (RIS3 document, chapter 2.5.5) notes 'low participation in joint programming, and Competitiveness and Innovation Framework Programme'. Slovakia participated in nine out of 31 ERA-NET projects, 18 out of 36 European Technology Platforms and three out of 11 joint programming initiatives. Slovakia also has had no thematic and/or sectoral priorities set for the jointly funded research, but the RIS3 document sets thematic priorities for the whole Slovak system of science and technology (see chapter 2 of this report for more details).

The RIS3 document (Measure 2.4 'Systemic support to and stimulation of international co-operation in science and technology') envisages 'systemic changes in co-ordination of

national policies for Horizon 2020, ERC and ERANET' and support to Slovak scientists participating in international technology platforms. Slovakia's participation in joint research agendas, joint calls, and joint programmes developed on the ad hoc basis. The MESRS, for example, supported call in the Joint Programme in Neurodegenerative Disease Research in 2013. No thematic priorities are stated for international co-operation.

The Ministry of Education, Science, Research and Sport of the Slovak Republic (MESRS) performs different activities in relation to Slovakia's participation in European and international R&D initiatives, such as JU ECSEL, JU ENIAC, Eurostars, EUREKA, etc.

The 2014 Annual Report on R&D summarises Slovakia's participation in several European initiatives:

- *Initiatives under Article 187 of the Treaty on the Functioning of the European Union (TFEU)*. The Slovak Republic allocates €0.679m to the ECSEL initiative (Electronic Components and Systems for European Leadership) in 2014. The Slovak University of Technology joined the Bio-based Industry Joint Undertaking (BBI JU). Slovakia has no participation in the IMI2 (Innovative Medicines Initiative 2), FCH2 (Fuel Cells and Hydrogen2), Clean Sky 2, and SHIFT2RAIL.
- Initiatives under Article 185 of the TFEU. Slovakia participated in five Eurostars projects. The MESRS supported the projects with the €0.22m in 2014. The Slovak Institute of Metrology should join the EMPIR (European Metrology Programme for Innovation and Research jointly undertaken by several Member States) in 2015.

So far the system of bilateral exchange and multilateral -operation schemes in science and technology has been the most important tool for the transnational co-operation. The system is financed by the MESRS and managed by the SRDA. The mobility schemes covered costs of travel, accommodation and subsistence. There were 15 multilateral schemes supporting joint research agendas both with the ERA countries and outside the ERA. The most important agreements outside the ERA referred to Slovakia's participation in the Joint Institute for Nuclear Research in Dubna (Russia). The Information on International Co-operation in Science and Technology in 2014 (MESRS 2015) summarises bilateral and multilateral schemes in S&T co-operation managed by the SRDA:

- ✓ The 13 multilateral schemes supported joint research agendas both with the ERA countries and outside the ERA. The most important initiatives related to the European Organization for Nuclear Research (CERN, €4.51m) and the European X-Ray Laser Project (XFEL, €2.0m). The most important agreements outside the ERA referred to Slovakia's participation in the Joint Institute for Nuclear Research in Dubna (Russia, €2.43m). Total cost of multilateral co-operation was €10.33m, of which membership fees €9.12m and project costs €1.21m in 2014 (2013: €9.12m and €1.47m). The MESRS published short evaluation of the project results in fields of (i) knowledge enhancement, (ii) support to economic growth, and (iii) popularising science and technology. Joint publications and joint project proposals were main outputs in field (i). Construction of prototypes and supply of high-tech technologies by Slovak firms were main outputs in field (ii). Lectures and media presentations were main outputs in field (iii).
- ✓ Six bilateral schemes supported 95 projects (€0.248m) with five ERA countries (the Czech Republic, Poland, Romania, Portugal, Greece and Bulgaria) and 12 projects with China in 2014. Bilateral schemes mostly supported mobility projects and covered costs of travel, accommodation and subsistence. The mobility schemes, unfortunately, were not aimed at specific joint research agendas.

The latest editions of the Annual Reports on R&D and the Annual Reports of the Slovak Research and Development Agency use to provide short information on main results of the bilateral and multilateral projects. Joint publications, joint use of research infrastructure and data exchange, were most frequently quoted results.

The Joint Research Centre of the European Commission and the Slovak Academy of Sciences signed a Memorandum of Understanding (MoU) on 5 June 2015. The aim of the memorandum is to establish the basis and the overall framework for future collaboration in the fields of mutual interest, including energy, transport, nanotechnology, reference (standard) materials, health and environment, innovation and growth as a start. Slovakia is also an important partner of the JRC's "Scientific support to Danube Strategy" initiative.

Slovakia joined the European Space Agency in 2015. The estimated costs of the participation were set at €2m in 2015. Slovakia is a full member of the European Association of leading national innovation agencies (TAFTIE) via the SIEA. Its Members make a major contribution to strengthening Europe's economic performance by supporting product, process and services innovation by implementing their countries' national and international Research, Development and Innovation Programmes. No policy document on the European Innovation Partnerships (EIPs) was in force by 2015 in Slovakia. Membership in the EIP happened on the ad hoc basis. Information on Slovakia's activities in the EIPs is scarce. The Slovak Republic is a member in the EIPs on 'Active and Healthy Ageing', 'Agricultural Productivity and Sustainability', 'Water' and 'Raw Materials'. Most Slovak activities concentrate in the 'Active and Healthy Ageing' partnership. Slovakia, for example, participates in the 'Visually Impaired Seniors Active Learning' initiative, 'Patient Medication Adherence' programmes and the 'Knowing Effects on Healthy Life Years' project.

The Slovak Government also planned support to activities developed under the European Union Strategy for the Danube Region. Slovakia created no special financing scheme for the Danube Strategy. Financial support for the abovementioned projects should be provided by the Danube Research and Innovation Fund, and the OPRI (source: the 2014 Annual Report on R&D).

The Czech Republic, Hungary, Slovakia and Poland formed regional partnership 'Visegrad Four' (V4). The Visegrad Fund foundation distributes small grants (up to €6000) on culture, science and research, education, youth exchanges and cross-border cooperation. The foundation also supports graduate and doctoral students from Associated EU Member Countries and Third Countries, who wish to study in the V4 countries.

The Operational Programme Research and Innovation enabled participation of the research organisations from the EU Member Countries in several calls in 2016. Foreign bodies were not allowed to tap the Structural Funds in Slovakia in period 2007-2013/15. The Ministry of Education, Science, Research and Sports also launched a call for foreign evaluators of the Slovak ESIF initiatives. All multimillion schemes supported from the Structural Funds were evaluated solely by Slovak experts in period 2007-2013/15.

The public research bodies (HEIs and the SAS) implement standard ex-post evaluation procedures (mostly based on the scientometric criteria and peer review). The procedures, however, have little impact on research funding by well-performing institutions.

### 4.2.2 RI roadmaps and ESFRI

The first draft of the National Research Infrastructures Roadmap (NRIR) was prepared by the MESRS in 2010. The NRIR should 'define funds and areas of specialisation for national research infrastructure'. The roadmap also should contain targets, priorities and funds up to 2013, and includes qualitative and quantitative evaluation indicators and 'targets for underdeveloped regions'. The NRIR draft was not approved by the Slovak Government.

The RIS3 document contained policy measures aimed at strengthening Slovakia's membership in the ESFRI project. The policy measures should be detailed in the Action Plan for the RIS3. The MESRS prepared new NRIR draft in 2014. The new draft was part of the first draft of the Action Plan for the RIS3 Strategy in 2014-2020. The final version of the Action Plan for the RIS3, however, did not contain the ESFRI Roadmap, and shifted the roadmap to 2016. The National Research Infrastructures Roadmap is likely to

enter into force in 2016 (source: personal communication with the MESRS staff). The MESRS continued support to Slovak organisations participating in various ESFRI initiatives on ad hoc basis.

The 2014 Annual Report on R&D summarises Slovakia's participation in the ESFRI projects. The Slovak Republic was a member / associated member in the European XFEL; ESRF; ILL 20/20; ESS – ERIC; and PRACE projects. Slovakia was an observer in the CESSDA – ERIC, EPOS, LIFEWATCH, EuroBioImaging, INSTRUCT and FAIR projects. Cost of participation in the abovementioned projects was €0.16m in 2014.

There is no policy document on transnational access to research infrastructures is Slovakia. Foreign researchers can access the Slovak research infrastructure via bilateral and multilateral projects on international co-operation in science and technology.

The Cyclotron Centre was the largest national research infrastructure project in Slovakia dating back to early 1990s. By 2015 the total sunk costs of the Centre were estimated €166m. The Slovak HEIs and public research institutions said they were unable to run any research projects in the Centre. The Slovak Government acknowledged failure of the project.

## 4.3 International cooperation with third countries

The Slovak Republic has no national strategy for internationalisation to foster coherent and sustainable cooperation with key third countries. Co-operation with the third countries happens on the ad hoc basic and is based on the intergovernmental agreements on co-operation in science and technology. Most co-operation with the third countries takes form of the bilateral exchange basis and supports mobility schemes (see chapter 4.2.1 for more details). Co-operation with the Joint Institute for Nuclear Research in Dubna (Russia) is exceptional for its amount of support and long-term history (dating back to 1950s). Other important third countries include the USA, China, Japan and Turkey. In the second half of 2015, the Ministry of Economy of the Slovak Republic has chaired the mutual cooperation of SIEA and the Israeli MATIMOP and consequently prepared a Call for Proposals for Joint R&D Projects between Slovakia and Israel. The funding for the first project funding is expected for the third quarter of 2016.

## 4.4 An open labour market for researchers

### 4.4.1 Introduction

The 2013 ERA Communication Synthesis report (p 41) recognises group of countries (including Slovakia) with the 'centrally regulated systems in motion' in Central and Eastern Europe. The Slovak HEIs and the SAS enjoy significant academic freedoms in terms of staffing and setting research/teaching programmes. Budgets of the HEIs and SAS, however, are strictly set by the MESRS. The HEIs are regularly evaluated by the Accreditation Commission. The commission has right to cancel poor-quality study programmes. The HEIs, however, use to re-appeal to courts. The MESR has right to stop establishment of new (private) HEI in case, the application is considered poor. The applicants used to re-appeal to court and win such cases in the past. The MESRS interventions mostly are significant for public HEIs, which derive their finance from the state budget. Trends in student markets (demographic change in particular) are the most significant factor for development of private HEIs in Slovakia.

The Eurostat data indicate there were 14,742 researchers in the full time equivalent in 2014 in Slovakia. The share of researchers in total population was 0.27% in Slovakia, 0.26% in Hungary and 0.34% in the Czech Republic in the same year. Numbers of researchers dropped by 2.9% in Slovakia, but increased by 22.8% in Hungary and 23.3% in the Czech Republic between 2010 and 2014. While the public support to research is stagnating, the numbers of researchers is not stagnating, but is decreasing in

Slovakia. The wages in research sector are rather low compared to other sectors of the economy and appear to be unattractive for young and talented researchers.[33]

There were changes in sectoral structure of researcher employment in last 10 years. The HEIs and the business sector accounted for major increases in researcher numbers, while the number of researchers in the government sector (SAS) stagnated in the abovementioned period (Eurostat).

### 4.4.2 Open, transparent and merit-based recruitment of researchers

The HEIs and the SAS follow both general and sector-specific regulations on labour markets for researchers.

The most important general regulations include the Labour Code and the Law on Civil Service. The SAS researchers and the HEI teachers are considered civil servants. Employment conditions are set by the 552/2003 Law on Civil Service. Article 3 of the Law sets requirements for civil servants (impeccability, qualification, health conditions, etc.). Tenders are required for the managerial positions only (Article 5), but most public bodies advertise posts for all types of employees. If a current managerial contract in civil service expires, managing authority may appoint a provisional manager for a maximum of six months. Then a tender for the post must be advertised. Any tender must be advertised at least three weeks ahead. Advertisements usually include criteria for a successful candidate (qualifications – certified by relevant documents, experience, language requirements). The decision is taken by a selection panel. Panel must have at least three members and one member must represent current employees of public body. The section panel includes internal members of the tenderer. There is no requirement for international members.

The results of the tender must be communicated to applicants in 10 days from the official end of the tender. There is a right of appeal and obtain financial compensation in case of discrimination based on applicant's gender, race, ethnicity, family issues, political opinions, membership in trade unions, etc.

Any employer can hire a worker for two consecutive years on a temporary contract. After two years the temporary contract turns to permanent one. Workers on temporary contracts have the same rights and duties as workers on permanent contracts.

There is no relevant measure supporting merit-based recruitment of researchers in Slovakia. Civil servant status determines salary levels for all senior academic and administrative staff. There, however, are sector-specific mechanisms in place to support merit-based career advancement in HEIs and public researcher organisations. Indent 6 of the 131/2002 Law on Higher Education sets competences of the Slovak HEIs in awarding academic titles and staffing academic posts. The criteria include set of research outputs (publications, citations, research grants) and teaching achievements (length of service, numbers of Master and PhD students). Research criteria, however, vastly differ between Slovak HEIs. The SAS recognises job posts of researcher ('grade IIb'), senior researcher ('grade IIa', equivalent of assistant professor) and leading researcher ('grade I', equivalent of research professor). Research outputs (numbers of papers and citations in the SCI/SSCI journals) are main criterion of the career advancement. The Slovak Commission for the Academic Titles works with the MESRS. It uses the stringiest research criteria (publications and citations) and awards the highest academic title in Slovakia 'The Doctor of Science' (DrSc.). The tittle is a matter of pure prestige and has no direct relation to work conditions and/or remuneration.

[33] The 2014 Annual Report of the SAS, for example, states the average monthly gross wage €935.

The 'centrally regulated systems' in Central and Eastern Europe (including Slovakia) use to require the habilitation[34] title to pursue an Academic career. Recognition of the foreign academic degrees and titles is regulated by the 293/2007 Law on Recognition of the Professional Qualifications in the Slovak Republic. The law recognises regulated and unregulated professions. Posts of university professor and assistant professor ('docent') are regulated. Any EU and/or Third Country national has to ask the Slovak Ministry of Education, Science, Research and Sports (MESRS) for recognition of his/her qualifications (including titles of professor and docent). Recognition of qualification is awarded solely for purpose of job execution. The title is not stated in the permanent residence card given to foreign professionals. Slovak citizens have their academic titles stated in their identity card. Post of rector or director of research institution are considered unregulated professions within the public administration. Fluency in Slovak is required for the state administration jobs. The language barrier is a considerable barrier for employment. Foreigners applying for public administration jobs do not need to prove officially they are fluent in Slovak, but in practice a good knowledge of Slovak is important for dealing with authorities. No public research organisation has a director of foreign origin and the University in Ruzomberok was the only Slovak HEI to have foreign-origin rector.[35]

There are two initiatives aimed at access to Slovak labour markets by the highly-skilled citizens of third Countries. The 404/2011 Law on Residence by Aliens implemented the 'Blue Card' directive and enabled for easier access by highly skilled third-country nationals to Slovak labour market. The Slovak Government published Concept Paper on the start-ups and considered introduction of the start-up visas for the third country nationals.

There is no comprehensive information on inward versus outward flow of researchers in Slovakia. The Eurostat data indicate some 525 foreign nationals, some 2.5% of total researchers working in the Slovak HEIs and public research organisations (in head counts) in 2013. The share changed little in the last 10 years.

Mobility by researchers to/from is assisted by several EU programmes. The Slovak branch of the EURAXESS agency has operated since 2004. The EURAXESS has its offices in Bratislava and five other regional capitals (Banská Bystrica, Košice, Prešov, Nitra, and Žilina).The EURAXESS information is important for Slovak researchers seeking better work conditions abroad. The EURAXESS services also include rich information on potential jobs for Slovak researchers abroad. The 2014 Country Factsheet for Slovakia on the FP7-PEOPLE Marie Curie Actions states that some 65 Slovak institutions obtained €11m for training 81 researchers coming to Slovakia in 2007-2015. Ukraine, Russia, USA, the Czech Republic and Slovenia generated most inflows of researchers to Slovakia. Some 191 Slovak fellows of the Maria Curie grants mostly headed for the USA and Czech Republic, Ukraine, Russia, Austria and the UK.

The Slovak Government introduced several policy measures supporting the attraction and reintegration of foreign based nationals:

- The Slovak Government passed the 210/2014 Resolution on the 'Strengthening analytical capacities in public administration' on 7 May 2014. The scheme creates jobs in central government bodies for Slovak graduates from foreign Universities. The Universities had to rank up to 200 in the Shanghai list, Times Higher Education, and/or Repec list of top World Universities. The scheme launched three

[34] Applicants for higher academic posts must past two procedures in Slovak HEIs. Applicants for the assistant professor title ('docent') have to defend their 'habilitation' works. Applicants for the (full) professor title have to present their 'inauguration' work and lecture. Posts of docent and professor are subject to acquisition of the abovementioned academic titles.

[35] The University, unfortunately, was infamous for high numbers of assistant professor titles awarded to the Polish citizens. The Polish Ministry of Education, for example, officially complained with the MESRS. It identified 18 cases of substandard habilitation procedures. Slovak media published many negative accounts on diploma selling and fast-track habilitation procedures in the University.

calls. The 2014 call received 29 applications and supported 15 applicants in three public institutions with €83,000[36].The 2015 call received 19 and supported four applicants.

- The Slovak Government passed the 368/2015 Resolution on the 'Support to Return by Slovak Professionals from abroad' on 8 July 2015\. The first call for this scheme was launched in April 2016. The call supported two types of Slovak returnees: (i) young professionals (up to age of 40) who graduated from foreign Universities, and (ii) experts ('highly qualified employees') working over 10 years abroad. The MESRS established a committee for selection and allocation of returnees to particular public institutions, the Slovak Academy of Sciences and the National Bank of Slovakia. Each public institution may apply for a maximum grant €0.15m.
- The SAS launched the SASPRO project in 2015. The project finances research stays by foreign nationals and reintegration of Slovak nationals in Slovakia. Foreign and Slovak nationals may apply for grants for 12-36 month stay with the SAS. The SAS covers 60% of the total costs. The Marie Curie scheme COFUND provides for the rest of the SASPRO budget. The SASPRO should support 54 grants (source: The 2014 Annual Report of the SAS).

### 4.4.3 Access to and portability of grants

Access to and portability of grants is quite limited in the Slovak Republic. Foreign researchers and/or Slovak nationals working abroad are not allowed to apply for grants funded from the Slovak State Budget, except for schemes on bilateral and multilateral co-operation in science and technology. Support from the Slovak funding bodies and awarded to a Slovak individual or organisation can be spent both on national territory and abroad (in case the project terms envisage research abroad, membership fees in foreign and international organisations, etc.). The 172/2005 Law on Organisation of State Support to R&D in theory enables participation by foreign researchers in Slovak research programmes, but there is little experience with this issue, given limited interest by foreign researchers in working in Slovakia. No plans for portability of national grants were scheduled in key R&I policies in Slovakia.

### 4.4.4 Doctoral training

The Law 131/2002 on Higher Education sets the HEIs may create their own fields of study in tertiary education. The HEIs have to consult the Accreditation Commission first and then apply to the MESRS for approval of study programme.

Two types of PhD courses are provided. 'Internal' PhD students get fellowships paid by the state, and distributed via HEIs and accredited training places (including Slovak Academy of Sciences). Fellowships are awarded for three years. Typical fellowship was €550 per month in 2015. The fellowship was exempted from tax. Internal PhD students also were exempted from health insurance contributions up to age of 30. Internal PhD students are expected to participate in teaching and research. Internal PhD students pay no fees for their studies within regular period of studies. External PhD programmes are designed for people employed outside the research and HEI sectors and do not involve any direct financial support. External PhD students are expected to defend their theses within five years since commencement of their studies. External PhD studies pay fees. Fees vary by faculties and study fields. Typical rates were €400-1,500 per academic year in 2015/2016. Some postgraduate programmes are taught in English. Postgraduate students can submit their PhD thesis in several languages, including English.

Numbers of the PhD students increased from 3,875 in academic year 1988/1989 to 12,182 in 2010/2011, but fell to 8,219in 2015/2016. Birth numbers declined considerably after 1989. The Slovak Universities coped with decreasing enrolment rates in early 2010s.

[36] Source: MESRS (2016): Grantový program pre posilnenie analytických kapacít vo verejnej správe {*Grant programme for supporting analytical capacities in public administration*}

There is no explicit support measure aimed at the innovative doctoral training in the Slovak Republic. The closest measures include (i) The Support to Human Potential Programme by the Slovak Research and Development Agency (see chapter 3.2.2), (ii) National Scholarship Programme and (iii) European initiatives, including Marie Curie Actions. The SRDA operated the 'Support to Human Potential' programme in 2006-2012. The programme supported, inter alia, international contests in mathematics and physics for undergraduate and postgraduate students, etc.). The SRDA drafted similar programme ('Support to Building Personal Infrastructure in All R&D Sectors') and submitted it to the Slovak Government in 2014-2020. The Slovak Government have not approved the new programme by end of 2015[37].

### 4.4.5 Gender equality and gender mainstreaming in research

Gender equality is set in the general laws (Slovak Constitution, Labour Code Law and the 365/2004 Antidiscrimination Law. Slovak law makes no special provisions on removing legal and other barriers to the recruitment, retention and career progression of female researchers. All women in Slovakia are entitled up to the three years maternity leave. Women on maternity leave need not fear loss of job and/or position. The Labour Code (Law No. 311/2001) guarantees return to the same type of work after that leave. The only exception from this rule is the fixed-term contract, which does not guarantee right for returning to the same type of work after the maternity leave.

Female researchers (in FTE) accounted for 41.3% of the total researchers in 2004 and 41.7% in 2013 in Slovakia. The Eurostat data on share of female researchers by sectors of performance indicate that females accounted for almost one half of the total researchers in higher education and the SAS, but less than 20% in the business sector. Females also were underrepresented in top managerial positions and boards of research bodies. There, for example, were seven female rectors on 36 Slovak HEIs by December 2015. The gender balance slowly improved over time. For example, there were only three female rectors on 33 Slovak HEIs in 2008. There were four female members of the Presidium of the SAS (out of the 15 total) in 2015. As for research funders, there were two females among 13 members of the Presidium of the Research and Development Agency, one female among six members of Presidium of the VEGA Grant Agency, and two females among nine members of the Presidium of the KEGA Grant Agency in 2015 (source: webpages of the respective agencies). There were no specific measures addressing gender imbalances in decision making processes in Slovak science sector.

## 4.5 Optimal circulation and Open Access to scientific knowledge

### 4.5.1 e-Infrastructures and researchers electronic identity

Measures supporting researchers' access to digital research services and electronic identity are provided by the Slovak Academic Network (SANET). The SANET was established in 1991 and operates as an independent civil association (non-profit body). The SANET members agreed to provide each other with Internet services. The SANET had 322 members (including all Slovak HEIs, institutes of the SAS, scientific libraries, 170 primary and secondary schools and several state institutions and municipalities) in 2015[38]. The SANET has no private sector members.

[37] The Slovak Government passed Resolution no 69/2016 the 'SRDA Programmes in period 2016-2019'. The three programmes include (1) Support to Building Personal Infrastructure in all sectors of R&D (€17.7m); (2) Support to business R&D and co-operation of businesses with research organisations (€58.3m); (3) Support to the H2020 projects (€16.0m). The programme (1) supports, jobs for post-docs, reintegration grants for the Slovak scientists, grants for foreign scientists, and projects for 'young and excellent research teams'. Projects on post-docs jobs and young excellent research teams have combined budget €14.1m. The project on reintegration grants and grans for the foreign scientists has budget €3.6m. The programme (2) supports projects in areas of the RIS3 specialisation. The total state support to the programmes (1), (2) and (3) was set to €92m. The private sector is expected to provide €17.2m.

[38] All information on the SANET activities is contained on the SANET webpage www.sanet.sk.

The SANET is self-managed, but its running costs are paid from the Education and Research Infrastructure chapter of the MESRS. The MESRS subsidised SANET services for high schools and universities with €1.98m in 2015. Amount of support did not change in last three years. The MESRS subsidy covers about 90% of the SANET budget. The rest comes from users and the EU-resources. The MESRS grant covers running costs of the network, costs of connection to the GEANT network, and membership fees in the RIPE-NCC, TERENA and CEENET organisations.

The SANET implemented four important projects in 2015:

a. 'SANET for Schools' project aimed at extending infrastructure of the e-services from higher education and academic institutions to public authorities and secondary schools in 77 Slovak cities.
b. 'SANET2' project aimed at building high-speed (100 gigabyte) network for Slovak academic community. The network should be connected to the GEANT trans-European network and the Internet.
c. Implementing the Eduroam services. The Eduroam (education roaming) is the secure, world-wide roaming access service developed for the international research and education community. Eduroam allows students, researchers and staff from participating institutions to obtain Internet connectivity across campus, and when visiting other participating institutions by simply opening their laptop.
d. Issuing TERENA Certificate Service (TCS). The SANET represented Slovakia in the TERENA network. In 2011 the SANET joined the TERENA Certificate Service (TCS) and started provision of server certificates issued by Comodo CA Limited. The SANET is offering TLS/SSL server certificates via SANET TCS.

The SANET also worked on changeover to dark fibre infrastructures and enhancing backbone capacities to 100 Gbps. The new infrastructure should be ready by 2015-2016.

### 4.5.2 Open Access to publications and data

There is no national policy on the open access to publications and data in the Slovak Republic. Slovak HEIs and public research institutions are allowed to set their own standards on open access. Individual researchers have voluntarily supplemented green access to the publisher's version by self-archiving their own final drafts free for all on the web.

National data on the share of Open Access (OA) publications in the whole scientific production are not available in the Slovak Republic. The 2014 European Commission's report on the 'Proportion of Open Access Papers Published in Peer-Reviewed Journals at the European and World Levels—1996–2013' indicated some 6.6% scientific papers accounted for the Green OA, 10.1% for Gold OA, 33.6% for other OA and 48.7% for Total OA in Slovakia in period 2008-2013. Respective numbers for the EU28 were 9.4%, 8.6%, 51.3% and 58.8%. Golden Access papers by the Slovak researchers was found mainly in journals on ICT (26%), mathematics & statistics (16%), general science and technology (69%), and psychology & cognitive science (51%) in the same period.

The Slovak Government used available resources from Structural Funds and enabled the subscription to a wide range of scientific journals and databases. The electronic information resources (EIS) include some 16 databases (Web of Knowledge, Scopus, ProQuest, Science Direct, Wiley, SpringerLink, Knovel, etc.) by five major providers (Association for Computing Machinery, Albertina icome, EBSCO Information Services, SUWECO CZ, Thomson Reuters). Users can access these resources directly or via new search engine Scientia.sk. Total cost of the access (€28.8 m in period 2008-2015, including licence fees and ICT infrastructure) was paid by the Operational Programme Research and Development.

# 5. Framework conditions for R&I and Science-Business cooperation

## 5.1 General policy environment for business

The 2015 Country Specific Recommendation for the Slovak Republic (indent 11) noted that 'the poor quality of Slovakia's business environment reduces the attractiveness of the country for both foreign and domestic investment. The inadequate efficiency and quality of the public administration and of the justice system are particularly detrimental to the business environment. The civil service suffers from high staff turnover and inefficient management of human resources. Efforts to tackle corruption have, to date, been limited'.

In the World league tables, the Slovak Republic accounted for the medium-good business environment. It ranked 29 out of 189 countries included in the 2016 Doing Business ranking (source: World Bank). The Slovak Republic fared slightly better than the Czech Republic (rank 36), Hungary (rank 42) and the same as Slovenia (rank 29). Among the V4 countries, only Poland (rank 25) achieved a higher position than Slovakia.

- The relative strengths of the Slovak business environment included: trading across borders (rank 1), ease of registering property (rank 5), procedures for resolving insolvency (rank 33)[39], ease of getting credit (rank 42), and getting electricity (rank 48);
- The weakest points of the Slovak business environment included protection of the minority investors (rank 88), tax burden and administrative hassle related to paying taxes (rank 73).

Tax burden (tax + social & health insurance costs), actually was lower in Slovakia (and also in the Czech Republic and Hungary) than that in EU15. Filling tax statements, however, was quite time demanding in Slovakia. It took 207 hours per annum for a small company to fill all statements required by the tax & insurance authorities in 2015 (CZ: 413 hours, HU: 277 hours; SI: 279 hours; LU: 55 hours; source: World Bank: the 2015 Doing Business database). Development of the e-government services may decrease amount of the administrative burden.

Many e-government projects, however, failed in Slovakia (see the 2014 Country Report for more details) . The e-Health project, for example, coped with significant delays. The e-Health project was approved in 2008 with budget of €250m. The e-Health originally should operate by 2010. The deadline latter was postponed to 2013. The project, however, was not ready by the end of 2015. The new deadline is January 2017. Some commercial health insurance companies resigned on the state-led project and introduced their own e-Health systems[40].

[39] Regulations on resolving insolvency enable debtors to enter liquidation and reorganisation proceedings and creditors to get their capital back in reasonable time. Proper regulations on resolving insolvency support process of 'creative destruction'. The term 'creative destruction' was coined by Joseph Schumpeter to denote a "process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one." Schumpeter (1942): *Capitalism, Socialism and Democracy*, New York: Harper & Row.

[40] Beňová, Z. (2015): Meškajúci projekt eHealth otestujú v štyroch nemocniciach {The lagging behind e-Health will be tested in four hospitals}, Pravda Daily, 29 June 2015.

## 5.2 Young innovative companies and start-ups

Support to the creation and early development phase of innovative enterprises has not been articulated well in the Slovak research and innovation policies[41]. The Slovak law does not recognise 'start-up' and/or 'spin-off' entities. The 'small and medium-sized enterprise' (SME) is not defined in the Slovak law[42].

The Slovak Government published three packages of 'pro-growth and pro-social policies' in 2014 and 2015. The packages, inter alia, contained a plan to provide tax reliefs and legislative support for start-ups established by 'young and talented entrepreneurs'. The Slovak Government passed the 'Concept paper for the support of start-ups and the development of the start-up ecosystem in the Slovak Republic' on 10 June 2015. [43] The paper listed government's intention on support to start-ups: (a) developing legal concept of start-up in Slovakia; (b) passing government strategy on start-ups; (c) introducing new form of business entity, with basic capital of 1 euro; (d) introducing tax reliefs for start-ups and business angels; and (e) introducing start-up visa for the third country nationals in Slovakia.

The introductory part of the Concept paper for the support of start-ups and the development of the start-up ecosystem in the Slovak Republic intends to react on the current status and existing challenges, take a comprehensive and coordinated approach on the topic and avoid fragmented or ad-hoc activities. The priority is that the implementation of state support is financed to a great extent from European structural and investment funds, in line with the Operational Programme Research and Innovation. The paper further discussed the (1) current status; (2) strategic objectives; (3) overview of the proposed solutions; (4) basic assumptions for the implementation of supporting measures for start-up;, and (5) proposed measures for the support of start-ups in the Slovak Republic.

Most discussions related to legal concept of start-ups. Financial support should not be disbursed to all new companies, but only to innovative ones. The white paper suggested, start-ups should be examined and selected for support by a special start-up commission. The commission should include representative of the abovementioned ministries and members by the business sector. No financial details of support were specified in the white paper.

The third country nationals are allowed to stay up to 90 days in Slovakia. The longer stay is subject to visa permit. The concept paper suggested a special visa regime for the 'innovative persons - third country nationals'. The applicant for the start-up visa must submit his/her proposal to the Slovak start-up commission. Successful applicants will be allowed to come and stay in Slovakia for 12 months. The best start-up owners will be further allowed to apply for the temporary residence permit.

Start-ups, digital single market and cybersecurity rank to key research priorities promoted by the Slovak Republic in the upcoming Slovak Presidency of the EU Council in the second half of 2016.

Cluster initiatives have been absent in the Slovak research and innovation policies until the year 2011 and they started emerging only relatively recently. A comprehensive system of cluster support policies had been envisaged in the 2011-2013 Innovation Policy, but was not implemented. The cluster policies were developed and implemented

[41] The SRDA implemented the 'Support to R&D in SMEs' scheme in 2007-2011. The scheme targeted micro-enterprises, spin-offs and start-ups, and supported feasibility studies, technology transfer and R&D project finance. Some 94 projects received support €7.77m in 2010 and 110 projects €5.05m in 2010 (sources: The 2010 and 2011 Annual Reports on R&D). The scheme expired in 2011 and has not been renewed so far.

[42] The Slovak State authorities approximate 'SME' via turnover and/or number of employees when launching calls financed from the Structural Funds based on the EU recommendation 2003/361 on definition of micro, small and medium-sized enterprises..

[43] http://www.rokovanie.sk/File.aspx/ViewDocumentHtml/Uznesenie-14906?prefixFile=u_

by the Ministry of Economy (Balog 2015: 37).[44] The pilot cluster scheme was launched as late as in 2013 and received modest €0.2m from the state budget. The second call (de minimis scheme) supported seven applicants with €0.18m in 2014. In 2015, the third call supported 7 applicants with €130,000.

Support to clusters is envisaged in the RIS3 document. The document proposes policy measures aimed at (i) increasing embeddedness by the MNE in the Slovakia's economy; (ii) improving integration of the Slovak firms into the global value chains; and (iii) support to clusters and joint research centres by public and private sectors. The Operational Programme Research and Innovation provides bulk of finance for the abovementioned initiatives in period 2014-2020.

The Ministry of Economy provides the Innovation Voucher scheme since June 2013. The de minimis scheme allocated €100,000 in total and the value of each voucher was set to €3,500. In 2014 the value of each voucher increased to €5,000 and the total budget of the scheme to €235,000. In 2015, total budget was raised to €370,000. Most applicants came from the fields of machinery and robotics, food industry and chemical industry. The call supported 66 applicants (+2 big companies) with € 347 703,95 in 2015.

The SIEA launched the Pilot Innovation Voucher scheme in June 2013. The de minimis scheme allocated €100,000 in total and the value of each voucher was set to €3,500. In 2014 the value of each voucher increased to €5,000 and the total budget of the scheme to €235,000. Most applicants came from the machinery and robotics, food industry and chemical industry (source: the 2014 Annual Report on R&D). The third call supported 70 applicants with €365,000 in 2015 (source: the SIEA webpage).

The Slovak Government and the Slovak President launched several activities to increase public awareness on start-ups and innovative companies. The Slovak President Andrej Kiska also supported development of the start-ups. He visited the Silicon Valley and the Massachusetts Institute of Technology in September 2014. He was joined by a group of young Slovak entrepreneurs, innovators, and academics. The President opened the Growth Company Forum conference in October 2015 in Berlin. He also did a start-up visit to Bulgaria (Opening of the Sofia Tech Park) and respectively Finland. He also discussed the concept of the Industry 4.0 with the German Federal Ministry of Economy and Energy and presented his intention to promote the significant potential of the Slovak Republic in research and innovation.[45]

## 5.3 Entrepreneurship skills and STEM policy

The Slovak Parliament passed the 61/2015 Law on Professional Education in March 2015. The law learned from the German, Swiss and Austrian experience and targets vocational training. The Slovak employees may co-operate with the public and private secondary schools and design the curricula according to the needs of regional economies.

Education and training curricula in the Slovak HEIs focus more on memorising facts than on developing critical thinking, problem solving, creativity and teamwork. Entrepreneurship education also is poorly developed in Slovak HEIs. The vast majority of tertiary students take just one field of study. Combination of fields (such economics and physics, engineering and law, etc.) is rare and subject to fees in Slovakia. The 2015 white paper on 'Support to Start-ups and Development of the Start-up Eco-System' on 10 June 2015 recognised the problem and suggested solutions aimed at overhaul of entrepreneurship education. The MESRS got task to develop and implement pro-business culture in higher education. The MESRS should draft scheme supporting establishment of spin-offs and start-ups by tertiary students 'with innovative ideas'. The HEIs should

[44] Balog, M. (2015): *Klastrová politika v podmienkach Slovenska* {*The Cluster Policy in Slovakia}, Bratislava, Slovak Innovation and Energy Agency.*

[45] Source: Kiska, A. (2015): *Kiska v Berlíne: Startupy patria do centra našej pozornosti* {*Kiska in Berlin: Start-ups in the middle of our attention*}

amend their study programmes and 'encourage natural interest in business by young people'. New programmes on financial literacy should be introduced and the Slovak HEIs should join international programmes on co-operation by industry and academia sectors.

## 5.4 Access to finance

The Slovak capital market is underdeveloped. The Bratislava Stock Exchange was established in 1991, but the stock market was essentially dead in 2010s. Slovakia is a 'banking economy'. The vast majority of businesses rely on bank finance.

The Slovak Republic provides good tax environment for the venture capital investment[46]. It makes no distinction between regular income and capital gains. No municipal or local tax is levied. No participation exemption may be applied. Slovakia also does not levy withholding taxes on dividends. It does levy health insurance payments on dividend income, but there is ceiling €49,440 for the tax base. Use of the risk capital finance, however, is limited. The 2014 edition of the Statistics on Fundraising, Investments & Divestment by the European Venture Capital Association (EVCA) does not state data for Slovakia[47]. The 2013 Central and Eastern Europe Statistics Report on venture capital states that the total private equity investment was €97.8m in 2012 and €2.0m in 2013 (0.138% and 0.012% of GDP respectively). The venture capital shares of GDP were well-below the European averages (0.262% and 0.253% respectively; source: European Venture Capital Association).

The first venture capital fund ('Fund of Funds') was established with help of the EU-PHARE programme in 1997 in Slovakia. The fund was managed by the former NADSME agency. It supported business angel networks and several venture capital funds. After period of mismanagement the NADSME was transformed to the Slovak Business Agency and the Fund of Funds was rebranded to the National Holding Fund (NHF) in 2014. By 2015 the NHF managed three venture capital funds: (1) Slovak Growth Capital Fund; (2) Fund for Innovations and Technology, and (3) Slovak Development Fund. The Fund for Innovations and Technology provided business advice and risk capital investments (from €0.02m to €1.50m) for a period of 4-6 years. By 2015 the fund supported only one company (€0.5m).

Slovak businesses noted lack of legal and financial support to private R&I and opted for self-help. The Slovak Venture Capital and Private Equity Association (SLOVCA) was established in 1995. The SLOVCA aims at 'increasing awareness of the public to the availability of private equity and venture capital to entrepreneurs, as well as to other investment and banking institutions, and economic, political and regulatory bodies in Slovakia'. The SLOVCA associated five members, three associate members and 25 partners in 2015. The young Slovak entrepreneurs established their own association in 2011 and the Business Angel network in 2014. The network had 25 investors in 2015. The Association of the Slovak Young Entrepreneurs joined the Young Entrepreneurs' Organization of the European Union in 2014. The SLOVCA and the Association of the Young Slovak Entrepreneurs launched an innovation prize competition 'The Business Idea of the Year'. The competition became increasingly popular with young entrepreneurs. Number of participants increased from 274 in 2012 to 245 in 2014. Most ideas are coming from the IT sector.

In 2008 the Slovak Government decided to implement the JEREMIE initiative. There was little experience with managing financial engineering schemes. It took four years to overcome the administrative complexity and create implementation structures for the JEREMIE. The European Investment Fund (EIP) implemented the JEREMIE programme in Slovakia via a network of financial intermediaries until the 31 December 2015 when the management was transferred to SZRB Asset Management who is also responsible for the implementation of financial instruments in the 2014-2020 programming period. Total

[46] For international comparison see the EVCA (2013): Tax benchmark study 2012.

[47] The 2014 Statistics Compendium by the European Trade Association for Businesses Angels, Seeds Funds and Other Early Stage Market Players also contains no data on Slovakia.

allocation for the JEREMIE programme is approximately €130m. The JEREMIE has two capital relief instruments: a first loss portfolio guarantee and a portfolio risk sharing loan. In addition it also has three venture capital instruments: a €7.3m seed fund which invests in early stage start-ups up to €0.2m, a €17.5m venture capital fund investing up to €1.5m in growth stage start-ups, and a €12m venture capital co-investment instrument that invests in start-ups up to €2.75m. Most of the funds are expected to be invested before the deadline 31 October 2016 despite the time shortages. The JEREMIE initiative seems to cope with administrative complexity. The JEREMIE is financed from three Operational Programmes and managed by three different ministries of central government. The MESR launched last JEREMIE call as late as in July 2015.

## 5.5 R&D related FDI

There is no official available data on the R&D related FDI in the Slovak Republic. However, the country has enjoyed a significant influx of the foreign direct investment (FDI) over the past few years. The automotive industries, consumer electronics, financial services and information and communication services were prime targets for the FDI in Slovakia. The MNE are highly important for employment, value added and exports in Slovakia (see chapter 3.3.2 for more details).

The automotive industry was the backbone of the Slovak economy. It employed 60,828 people, generated turnover €11b and value added €2.8b in 2012. Total employment induced by the automotive industry accounted for 201,820 people (Balog et al 2012: 45)[48].

## 5.6 Knowledge markets

Slovakia adopted standard European legislative framework for support to the IPR. The IPRs are governed by the 435/2001 Law on Patents and Trade Marks. Last amendment of the law was in 2009. The law defined main types of intellectual property rights (patents, trademarks, licenses) and sets procedures for patent applications and protection of the intellectual property rights. The law also implemented the European Patent Convention in Slovakia. The 506/2009 amendment of the law implemented the Council Directive 2008/95/EC on trademarks. The Industrial Property Office offered a life-long learning programme on the IPR for entrepreneurs in 2013 and 2014. The programme modules included (a) basics of the IPR law; (b) marketing, management and economics of creative processes; (c) information on IPR, and (d) advanced IPR law.

The 2014 Annual Report on R&D noted that 'Slovakia has been lagging behind in patenting activity for long time. Slovak science is significantly closed and international co-operation in science is limited. Slovakia accounts for low numbers of patents per million population'. The report summarises patent statistics by the Industrial Property Office. By end of 2014 there were some 15,015 patents in Slovakia, of which 2,358 by national and 12,657 European applicants. Most European patents were awarded in 1990s, 2000s and early 2010s. Some 94 patents were awarded on Slovakia in 2014.

Information on the knowledge market is scarce in Slovakia. The Eurostat data indicate that Slovakia significantly lagged behind the EU average and also its regional competitors in registering intellectual property rights (IPR):

- Slovakia registered 0.83 EPO patent applications per billion gross domestic product (GDP) in 2012 (EU28: 4.40, CZ: 1.46, Hungary: 2.37);
- Slovakia registered 3.87 EPO Community trade mark applications per billion GDP in 2013 (EU28: 6.13, CZ: 5.73, Hungary: 4.83);
- Slovakia registered 3.87 EPO Community trade mark applications per billion GDP in 2013 (EU28: 6.13, CZ: 5.73, Hungary: 4.83);
- Slovakia registered 0.89 EPO Community design applications per billion GDP in 2013 (EU28: 1.18, CZ: 1.59, Hungary: 0.59).

The abovementioned data indicated that system for protecting IPR was rather inefficient. It also was not affordable compared with international benchmarks. The standard European legislative framework probably was not enough for developing modern IPR markets. The MNE use to apply for high numbers of EPO patent applications, in the ICT and pharmaceutical industries in particular. No MNE, unfortunately, had its headquarters in Slovakia.

The Slovak policies on the IPR recognised weakness of the knowledge markets and set unambitious targets for the IPR development. The Operational Programme Research and Innovation (major source for the RIS3 policies), for example, envisages grants and risk

[48] Balog, et al (2015): *Automobilový priemysel na Slovensku a globálne hodnotové reťazce* {The Automotive Industry in Slovakia and Global Value Chains} Bratislava: The Slovak Innovation and Energy Agency

capital schemes to support some 30 patents, industrial designs and trade marks in the Bratislava Region, and 390 intellectual property rights in the non-Bratislava regions in period 2014-2020.

## 5.7 Public-private cooperation and knowledge transfer

### 5.7.1 Indicators

**Funding**

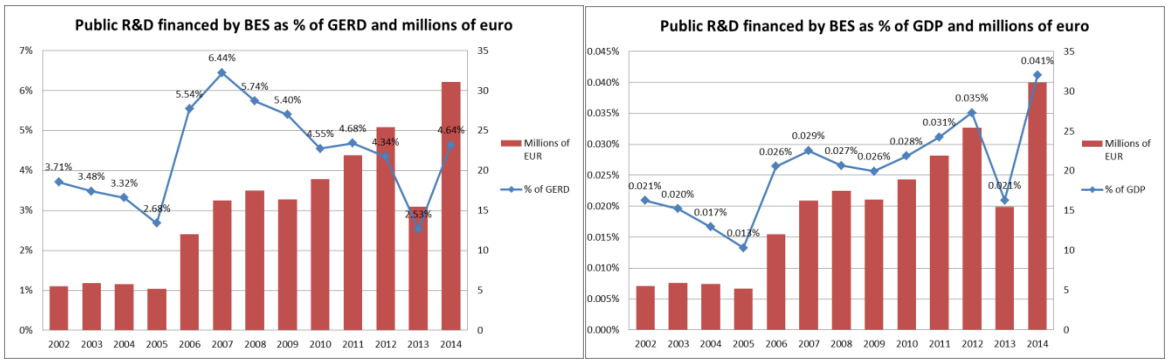



**Figure 16** BES-funded public R&D in the SLOVAK REPUBLIC as % of GERD (in €MLN) and % of GDP

The level of the Slovak business enterprise (BES)-funded public R&D expenditure as a percentage of GERD was generally increasing with fluctuations between 2007 (6.44%, €16.2m) and 2014 (4.64%, €31m). The Compound Annual Growth Rate (CAGR)[49] which sets the trend for the period 2007 to 2014 is 9.71%. The significant drop in 2013 may be mainly due to an increase of R&D spending of domestic firms whose share appears to be more significant than the one of foreign firms. As a percentage of GDP, it follows a similar trend with the highest value recorded in 2014.

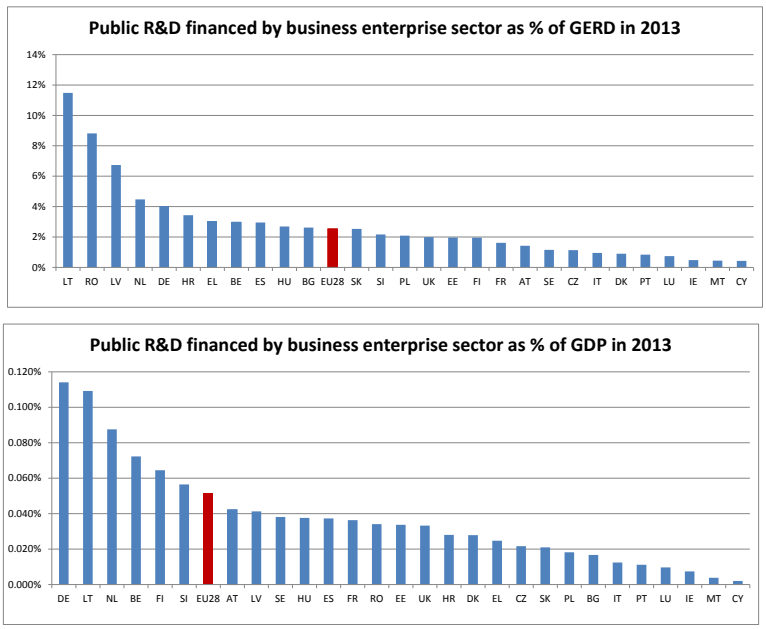



**Figure 17** BES-funded public R&D as % of GERD and as % of GDP in 2013 in Member States[50]

[49] CAGR = $(FV/PV)^{1/n}-1$, where FV is the future value, PV is the present value and n is the number of years.
[50] 2013 was chosen as the latest data series providing a full comparison within EU-28.

The two charts in Figure 16 show the values of BES-funded public R&D in all EU-28 as percentages of GERD and GDP respectively. In the Slovak Republic, the level of public R&D financed by the BES expressed as % of GERD is exactly below the EU-28 average. When expressed as % of GDP, the level is below the one of best performers and of the EU-28 average, which indicates a modest level of science-business collaboration.

On the demand side, the Slovak economy is characterised by a dominance of SMEs, with a dominant representation of micro-enterprises (entrepreneurs and firms employing less than 10 employees with a turnover lower than €2m per year constitute 96 % of all the enterprises in the Slovak Republic) and the SMEs investment to the R&D is hindered by the lack of human and financial resources. Another reason is the low level of R&D activities of large companies owned by international corporations who have little ambitions to establish research centres and reallocate their R&D activities to the Slovak Republic.[51]

On the supply side, the framework conditions to incentivise and reward academics engaged in cooperation with industry have been missing so far. Researchers are evaluated according to their publication, citation rate and teaching achievements, whereas the collaboration with industry plays little role in career advancement by public sector researchers.

**Structural funds devoted to knowledge transfer**

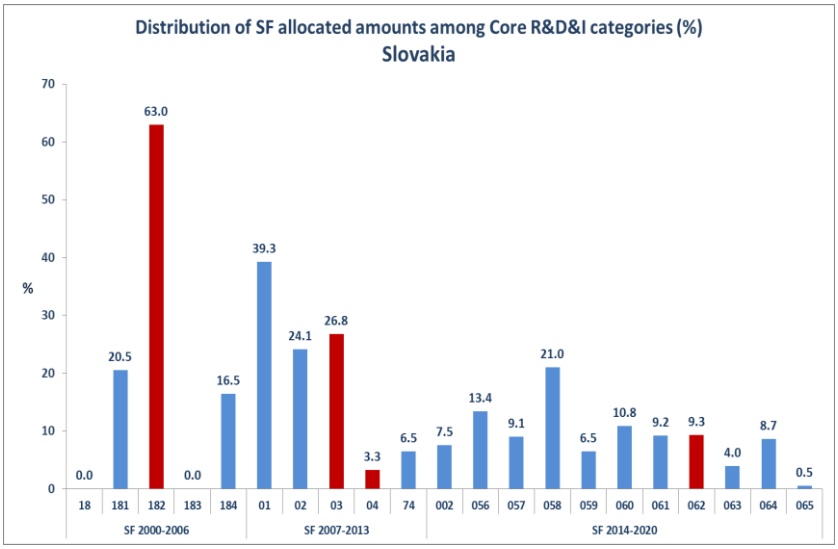



**Figure 18** Structural Funds for core R&D activities 2000-2006, 2007-2013 and 2014-2020[52]. We use the categories: 182 (2000-2006), 03 and 04 (2007-2013) and 062 (2014-2020) as proxies for KT activities.

[51] Data on private research funding are quite scarce. Annual reports of several companies provide limited and uncategorised data on R&D spending: Continental Matador Rubber (automotive parts): €21.452m (2013), US Steel: €3.1m (2014), Biotika (pharma) €2.456m (2014), Slovak Power: €2.0m (2014) and Slovnaft: (oil processing) €0.488m (2014).

[52] Figure 18 provides the Structural Funds allocated to the Slovak Republic for each of the above R&D categories. The red bars show the categories used as proxies for KT. Please note that the figures refer to EU funds and they do not include the part co-funded by the Member State. The categories for 2000-2006 include: 18. Research, technological development and innovation (RTDI); 181. Research projects based in universities and research institutes; 182. Innovation and technology transfers, establishment of networks and partnerships between business and/or research institutes; 183. RTDI infrastructures; 184. Training for researchers.
The categories for 2007-2013 include: 01. R&TD activities in research centres; 02. R&TD infrastructure and centres of competence in specific technology; 03. Technology transfer and improvement of cooperation networks; 04. Assistance to R&TD particular in SMEs; 74. Developing human potential in the field of research and innovation.
The categories for 2014-2020 include: 002. Research and Innovation processes in large enterprises; 056. Investment in infrastructure, capacities and equipment in SMEs directly linked to Research and Innovation activities; 057. Investment in infrastructure, capacities and equipment in large companies directly linked to Research and Innovation activities; 058. Research and Innovation infrastructure (public); 059. Research and Innovation infrastructure (private, including science parks); 060. Research and Innovation activities in public research centres and centres of competence including

The Slovak Republic allocated only 9.3% of its structural funds for technology transfer and university-enterprise cooperation in the 2014-2020 programming period (compared to 30% in the 2000-2006 programming period and 63% in the 2007-2013 programming period). It is lower than the EU average of 15.7% (it was equal to the EU average of 30% in the 2007-2013 programming period and much higher in the 2000-2006 programming period where the EU average was 26%).[53]

**Cooperation**

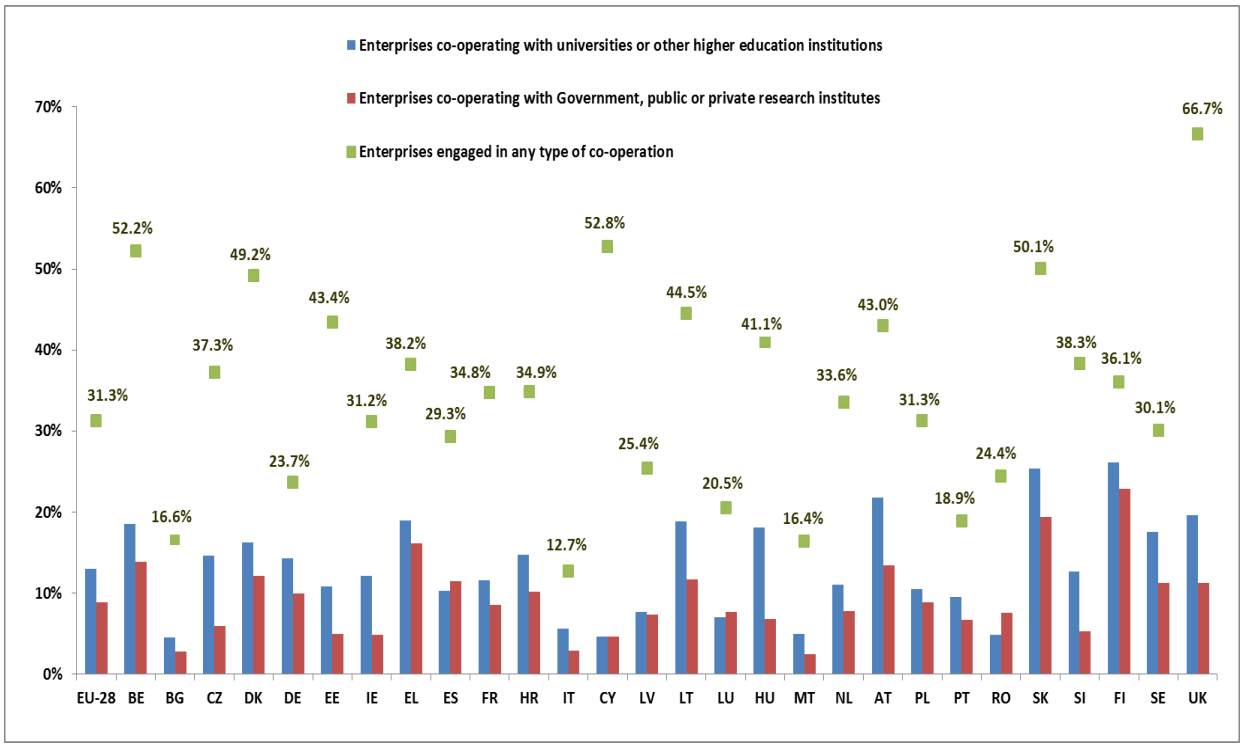



**Figure 19** CIS survey 2012 – share of enterprises cooperating with academia

The Figure 19 illustrates the level of cooperation activities of innovative companies in the EU-28, according to the CIS 2012. In the Slovak Republic, 50.1% of innovative companies engage in any type of cooperation (above the EU average of 31.3%). Yet, only half of them (25.4%) cooperate with universities and higher education institutions and only 19.4% cooperate with government or public or private research institutes. The Slovak Republic has quite an impressive result, comparable to the cooperation rate of Finland – one of the innovation leaders (26% of innovative companies that work with higher education institutions and 23% with government or public or private research institutes). However, these results do not transpose in an effective knowledge transfer between academia and business measured by outputs such as patents or number of spin-offs. The Slovak Republic is ranked as "moderate innovator"[54] by the Innovation Union Scoreboard.

networking; 061. Research and Innovation activities in private research centres including networking; 062. Technology transfer and university-enterprise cooperation primarily benefiting SMEs; 063. Cluster support and business networks primarily benefiting SMEs; 064. Research and Innovation processes in SMEs (including voucher schemes, process, design, service and social innovation); 065. Research and Innovation infrastructure, processes, technology transfer and cooperation of enterprises focusing on the low carbon economy and on resilience to climate change.

[53] This allocation is not very precise, since the category 'Research and Innovation in SMEs' also comprises SMEs including voucher schemes, which may be used for contract research, whereas the funds allocated to infrastructure are the highest.

[54] The latest Innovation Union Scoreboard 2015 ranks the Slovak Republic as moderate innovator.

**Technology Transfer Offices (TTOs), incubators and technological parks**

According to the Knowledge Transfer Study 2010-2012, the circumstances for technology transfer within universities are not satisfactory in the Slovak Republic and, apart from the large projects funded from Structural Funds, little activity is in place. Some minor funding projects have been set up to allow universities to build their own technology transfer offices and start technology transfer activities. However, these projects are now at the end and although some progress has been made in the funding of technology transfer offices in universities, they are in the early stages of development.

Technology transfer received substantial support from the European resources in Slovakia. Over the period 2013-2015, the Operational Programme Research and Development (OPRD) supported the creation of seven University Science Parks (USP) and five Research Centres (RC), out of which four in Bratislava[55]. The OPRD also supported creation of the eight Competence Centres with €50.8m in the same period. The Operational Programme Research and Innovation (OPRI) launched call for the second phase of the USP and RCP building in January 2016. The call allocated €17.7m for the non-Bratislava Region and €5.9m for the Bratislava Region. The OPRI also launched a call for Industry Research Centres in areas of the RIS3 specialisation (€200m) and Support to Innovation and Technology Transfer scheme (€75m) in February 2016.

The business and technology incubators prevail. They provide businesses a number of advantages such as reduced expenses, technical assistance, and access to internal or external network through collaboration with potential customers, partners and scientists from universities. In fact, the interest in incubators is diminishing. The Slovak Business Agency did a survey on incubator activities in 2011. The survey found 13 incubators hosting 88 firms and generating 602 jobs. The incubators seem to have had quite low impact on development of business environment.

The business and technology incubators struggled in 2010s in Slovakia. The EU schemes supported less-developed Slovak regions. Most incubators were established outside Bratislava. The technology and/or research-based spin-offs preferred locations close to universities and/or large businesses in Bratislava. Some incubators claiming technology status found it difficult to find real technology firms, and had to accept any firms.

The webpage of the Slovak Business Agency listed 18 business and technology incubators, of which three terminated their activities by 2015. There were 15 active incubators, of which seven claimed 'technology' status by 2015. There is no information on numbers and turnover of supported firms, support provided by the public authorities, technology profiles, etc.[56]

According to a report published by the bank Slovenska Sporitelna[57], the nationwide incubators network of the Slovak Republic has a capacity of 17.500 m2. The report mentions that €20m was spent on the functioning of the incubators (from the National Agency for Development of SMEs) and less than €1m for co-financing operating costs (from the programme Support for SMEs via a network of incubators).

[55] Source: Centre for the Scientific and Technology Information (2016): Projekty vedeckých parkov a centier na Slovensku {Projects of the Science Parks and Centres in Slovakia}.

[56] The EU pre-accession assistance helped establishing incubators, but did not provide finance for operating costs of incubators and firms. Some incubators used to be financed from municipal resources and found it hard to get funding. The incubators also were unable to provide complex services to incubated firms (law services, business planning, technology counselling)

[57] http://www.slpk.sk/eldo/2012/zborniky/025-12/21.pdf

**Share of public-private co-publications**

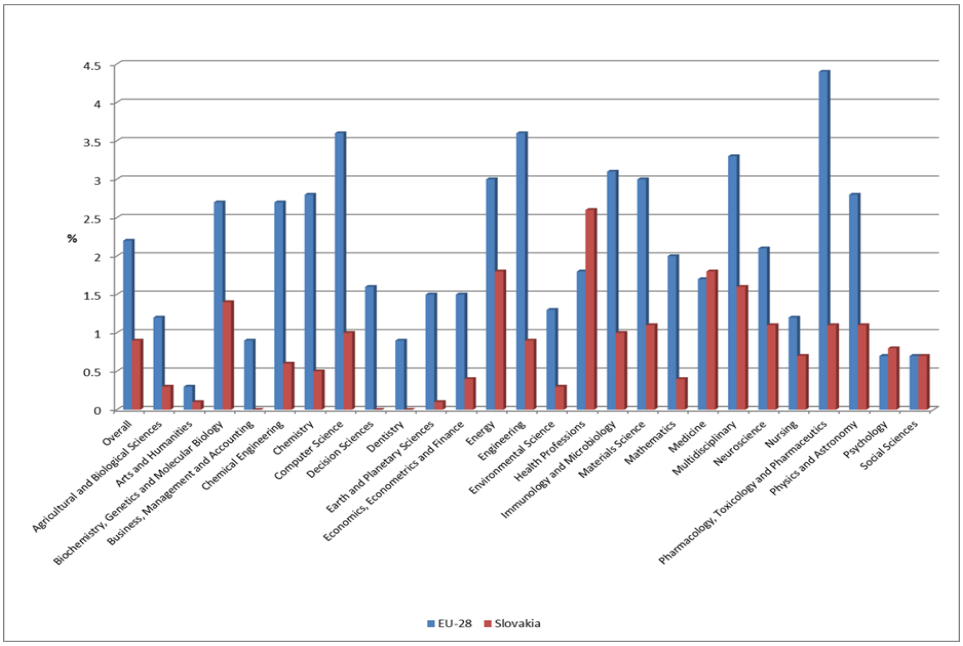



**Figure 20** Co-publications by field 2003-2013 in the Slovak Republic. Scopus database

The Figure 20 shows the 2003-2013 average percentage of academia-industry co-publications by field in the Slovak Republic compared to the European average. The percentage of co-publications almost did not change over the past ten years (2003-2013), with 0.6% of academia-business publications in 2013. In 2013 the Slovak Republic had only 6.8 public-private co-publications per million of population compared to 29 for the EU-28 (and 17.5 for the Czech Republic, 12.8 for Hungary). The domains with the highest percentage of co-publications (excluding multidisciplinary publications) are health professions, medicine, energy and biochemistry, genetics and molecular biology.

**Patenting activity of public research organisations and universities together with licensing income**

The Eurostat data on the numbers patent applications to the European Patent Office (per million inhabitants) indicate an increase from 3.84 in 2004 to 12.82 In 2013. The overall level of patenting activity, however, was quite low in Slovakia. There were 113.27 EPO patent applications in the EU 28 in 2013 (CZ: 23.16; HU: 25.3; PL: 12.67; AT: 223.96).As for the sector of performance, the Slovak Universities produced 0.031 and the public research institutions 0.058 EPO patent applications in 2012 (latest available year), The EU28's Universities and public research institutions generated 0.919 and 1.335 EPO patent applications respectively in the same year.

There is no consistent national data on co-operation by public and private sector, researchers' mobility or joint collaborative research. However, some scarce evidence on such activities can be found. In 2014 the Slovak Academy of Sciences (SAS) was awarded seven patents, including two patents granted in the US, while the institutes of SAS signed 21 patents, eight of which are filed as PCT. In 2013 SAS applied for 15 patents and obtained four patents, signed 52 business research contracts and participated in 23 collaborative workplaces with the businesses, whereas the total revenue from these activities was €972.000.[58]

[58] Annual Report of the Slovak Academy of Science 2013 and Annual Report of the Slovak Academy of Science 2014.

### 5.7.2 Policy measures

Knowledge transfer schemes have been supported from the Operational Programme Research and Development (OPRD) and the Operational Programme Competitiveness and Economic Growth (OPCEG).

The OPCEG has been the largest source of support to the Slovak SMEs. Its measure Innovation and technology transfers allocated €530.5m to over 1181 businesses by December 2014, supporting the purchase of new technologies by SMEs in manufacturing industries.[59]

The OPRD has implemented two national knowledge transfer promotion projects focused on transfer of knowledge and technology from R&D into practice and on national infrastructure supporting technology transfer. The project Transfer of knowledge and technology from research and development into practice invested €226.9m in the period 2008-2013/15 and supported building university science parks and research centres with Slovak HEIs and the Slovak Academy of Sciences, applied research projects, and R&D co-operation projects. The project National infrastructure supporting technology transfer in the Slovak Republic invested €8.2m in the period 2010-2015 and supported establishing technology transfer centres in Slovak Universities and public research organisations. The main activities of the technology transfer centres were conferences and seminars on technology transfer, protection of IPR and commercialisation of results.[60]

Currently there are no major knowledge transfer schemes in place. The Action Plan of the Operational Programme Research and Innovation (OPRI), intented to be the major source of research finance in the period 2014-2020 in the Slovak Republic, was not approved yet.

A pilot cluster scheme was launched in 2013, receiving about €0.2m from the state budget. The second call for clusters (de minimis scheme) supported seven applicants with about €0.18m in 2014. Support to clusters is also envisaged in the RIS3 document. This document proposes measures to increase the embeddedness of multinational companies in the Slovak economy, improve the integration of the Slovak firms in global value chains and support clusters and joint research centres. [61]

The Slovak Innovation and Energy Agency (SIEA) launched the Pilot Innovation Voucher scheme in June 2013. This scheme allocated €100,000 in total and the value of each voucher was set to €3,500. In 2014 the value of each voucher increased to €5,000 and the total budget of the scheme to €235,000. Most applicants came from the machinery and robotics, food industry and chemical industry. The third call supported 70 applicants with €365,000 in 2015.

**Conclusions**

The Slovak Republic is characterised by a modest level of public-private cooperation in R&D, as evidenced by the low level of private investments in publicly-performed R&D. The country has implemented a number of policy measures to stimulate knowledge transfer but they are mainly focused on building KT infrastructure while the majority of funding comes from external sources (mostly Structural Funds) rather than domestic private or public sources, which raises serious questions of sustainability.

[59] These knowledge transfer projects targeted public research institutions and firms. No incentives and programmes for individual public researchers involved in cooperation with industry are available.

[60] For example, the Slovak Academy of Sciences, established the Office for Technology and Knowledge Transfer and the Protection of Intellectual Property.

[61] The Operational Programme Research and Innovation provides bulk of finance for the abovementioned initiatives in period 2014-2020.

The recent evaluations point to several reasons for the low level of knowledge transfer activities. The low absorption capacity from the demand side results mainly from a very large number of SMEs with only very limited innovation capacities and the preference for technology import both in case of multinationals and domestic companies. The very low interest from the supply side is mainly due to insufficient incentives for researchers involved in knowledge transfer activities, very low support for business creation and development of spin-off companies, a lack of preparation of R&D institutions for the cooperation with the business sector and a very weak performance in patenting and licencing.

The approval of the Action Plan to implement the OPRI and the Action Plan to implement the RIS3 is still pending. Their endorsement is vital to allow the application and financing of measures aimed at fostering science-academia collaboration and knowledge transfer.

The recently approved Concept paper on the support to start-ups and development of the start-up eco-system is an important instrument to foster knowledge transfer. Yet, at this stage, it is only a strategic document which needs to be followed-up by concrete policy measures to ensure its implementation.

## 5.8 Regulation and innovation

The impacts of proposed regulations on innovation are assessed in section 3.5 "Innovation" of the Business Impact Analysis (BIA), which is an important part of the Regulatory Impact Assessment (RIA) process in Slovakia. This process is based on the Unified Methodology on Assessment of Selected Impacts. This document, effective since October 1, 2015 (with minor changes effective since April 1, 2016) provides detailed instructions on how to evaluate possible impacts of the proposed material, e.g. social, environmental or impacts on business environment.

The aforementioned section of BIA focused on innovation includes the assessment of impacts on support of innovations, introduction of new production methods and technologies, launch of new products, intellectual property rights, effectiveness of production and resource utilisation, as well as on creation of new jobs in research and development. RIA is given a high priority by the Ministry of Economy of the Slovak Republic, which is a coordinator of impact assessment process in Slovakia. In the near future, the Ministry plans to focus also on the future proof regulation concept, which will have the potential to facilitate the creation and implementation of innovations in Slovak economy.

The evaluation culture in Slovakia is rather a recent phenomenon, but it has shown signs of progress. The assessment of the impact of regulation on innovation is not very frequent:

- The 2007 Innovation Strategy for period 2007-2013 was implemented via the 2008 and 2011 Innovation Policy documents. The Ministry of Economy used to publish evaluation reports on implementation of the 2008 and 2011 Innovation Policies. The reports summarised major policy measures aimed at support to innovation from the European and national resources.
- The Smart Specialisation Strategy (the RIS3 document) superseded the 2007 Innovation Strategy in 2014. The chapter 2.3 of the RIS described innovation environment in Slovakia and analysed tools for financial support, innovation performance and innovation governance. The chapter noted (a) fragmented national system of innovation governance; (b) poor co-operation by the ministries of economy and education in field of innovation; (c) lack of regional system of innovation governance. The SWOT analysis (chapter 3.1) of the RIS3 document explicitly points to 'dysfunctional national system of innovation' and 'lack of comprehensive strategy for research and innovation'. Chapter 5 presented some far-reaching plans for reform of innovation governance in Slovakia, including merger of three innovation funding agencies to one ('Technology Agency') and introduction of the indirect funding for innovative enterprises. Introduction of tax

deductions for R&D activities has been the only reform implemented by end of 2015.

No analyses/reports on reducing the negative impacts of regulations on innovation were available in Slovakia.

## 5.9 Assessment of the framework conditions for business R&I

The Doing Business data indicate that the Slovak Republic accounts for relatively friendly business environment (with some notable caveats in construction permits and administrative hassle related to tax payments). From 2015 to 2016, Slovakia improved its ranking in Paying Taxes (27$^{th}$ rank) and Construction Permits (26 rank) indicators.

While general framework conditions for business are rather business-friendly, development of innovation-friendly environment lags behind expectations. The 2015 edition of the Innovation Union Scoreboard (IUS) ranked Slovakia 26 out of 34 countries. The absolute value of the Summary Innovation Index (SII) improved to some degree in period 2007-2014 (0.295 versus 0.360). The gap against the EU-28 SII value (0.517 versus 0.550) slightly decreased. Slovakia's position against its main competitors in the region (the Czech Republic, Hungary and Poland) somewhat improved in the above-mentioned period.

The 2015 IUS report found that 'Slovakia performs below the EU average for all dimensions, except Human resources, and also for most indicators'. Major strengths related to the (i) sales share of new innovations, (ii) new doctorate graduates, and (iii) shares of medium- and high tech exports in total exports. Major weaknesses related to the (i) IPR variables (license and patent revenues from abroad, PCT patent applications in societal challenges and PCT patent applications), and (ii) non-EU doctorate students. The IUS data should be observed with care. High supply of secondary and tertiary graduates points to mass rather than high-quality education. Moreover, about 15% of the total tertiary students studied abroad. Many of them had no intention to return back (see chapter 4.4.2). The shares of medium- and high tech exports in total exports refer to Slovakia's dependency on two key industries (automotive and consumer electronic). These key industries were introduced by the MNE, rather than country's own effort to develop high-value added production.

The basic policy mix has not changed much in programming periods 2006-2008, 2007-2013/15 and 2014-2020. It has relied on means provided by the Structural Funds (in 2007-2013/15) and ESIF (in 2014-2020). The mix supports policy measures aimed at infrastructure building, creating linkages between the academia and industry sectors, technology transfers, and venture capital schemes. The technology transfer schemes (supported from the European resources) generated high numbers of applications and accounted for good absorption capacity. In the same time, the technology transfers tended to distort the market competition and contributed little to building national research capacities. Research infrastructures accounted for the highest allocations by the OPRD. Resources coming from Structural Funds supported a high number of the Centres of Excellence, University Science Parks and Research Centres and concentrated on the infrastructure building. However, the EU investment was not complemented by national investments in human resources and project finance.[62]

The industry-academia co-operation projects seemed to have low impact on increase in BERD so far (see chapter 3.5.1). Basic supply and demand-side policies have been stated in main R&I policies (the 2007 innovation policies, the RIS3 document), but synergies between the supply and demand-side policies are rather weak. On the demand side, the Slovak economy is characterised by a dominance of SMEs whose investment in R&D is hindered by a lack of human and financial resources, while the Slovak Republic fails to attract R&D intensive FDI and large international corporations operating in the

[62] The Structural Funds provided money for buildings and equipment. The Slovak Government provided limited complementary resources for operating costs, salaried and research projects.

country tend to perform their R&D in their headquarters. On the supply side, better framework conditions to incentivise and reward academics engaged in co-operation with industry are still missing'.

The most recent innovation policies indicate a positive shift towards more sophisticated innovation policies in the near future in terms of new agendas (support to clusters), target groups (MNEs), and modes of funding (innovation vouchers, tax reliefs). The lack of co-ordination between key ministries, fragmentation of support to R&I performers, and lack of good quality evaluation procedures, unfortunately, remained key weaknesses of the Slovak R&I policies.

# 6. Conclusions

### Meeting Structural Challenges

The main challenges faced by the national R&I system are listed in the Executive summary of this report. A summary table with structural challenges is presented below.

**Table 8:** Structural challenges of the national R&I system

| Challenges | Policy measures/actions addressing the challenge | Assessment in terms of appropriateness, efficiency and effectiveness |
|---|---|---|
| **1. Weak R&D system restricts co-operation between academia and industry sectors.** | The Slovak government used means provided by the Structural Funds and applied policy measures targeting building R&D infrastructure, building linkages between the academia and industry sectors and support to technology transfer. | (±) Positive trends in research spending. Nominal amount of GERD and BERD doubled in 2008-2014. The share of GERD and BERD in GDP remains low compared to the EU28 average.<br>(+) High number of research infrastructure projects (67 Centres of Excellence, 93 R&D Centres, 8 Competence Centres, 11 Science Parks).<br>(+) R&D Centres and national projects on R&D infrastructure perform well.<br>(-) The Centres of Excellence are numerous and face sustainability problems.<br>(+) Several Science Parks were still under construction in 2015. It is too early to assess their efficiency.<br>(+) The MESRS and the Accreditation Commission implemented several initiatives aimed at increasing science excellence. |
| **2. Unfledged system of innovation governance.** | The Slovak Government Council for Science, Technology and Innovation (SGCSTI) started its operation in April 2013. After 2-year hiatus, Slovakia had top body for RDI governance. | (+) The SGCSTI is chaired by the Prime Minister and involves all major stakeholders of the Slovak national system of innovation. The council was very active and helped to draft four versions of the RIS3 document in 2013.<br>(-) The Action Plan for R&I was not adopted by the end of 2015.<br>(-) Reform of the Slovak Academy of Sciences stalled in 2015.<br>(-) No National Roadmap for Research Infrastructure was developed by 2015.<br>(-) No reform of research funders was started in 2015.<br>(-) Regional innovation governance bodies were missing by the end of 2015. |
| **3. Low private innovation outputs by domestic firms and limited cooperation with multinational companies.** | The RIS3 document proposes policy measures aimed at (i) increasing embeddedness by MNCs in the Slovak economy; (ii) improving integration of the Slovak firms into the global value chains; and (iii) support to clusters and joint research centres by public and private sectors. | (±) Shares of innovative companies increase over time, but remain well-below the EU28 average. The OPCEG policy measures have impressive budgets, but rather ambiguous results.<br>(±) The technology transfer schemes are inexpensive, simply-to-implement and very popular with users. They helped create jobs and increase turnovers and exports. In the same time the technology transfer schemes have potential for market distortion, corruption and inefficient allocation of resources.<br>(+) The Slovak Government published the Concept Paper on Start-ups.<br>(+)The OPRI calls are launched in 2016 |

| | | |
|---|---|---|
| | Two policy measures were financed from the Operational Programme Competitiveness and Economic Growth (OPCEG). | (+) The Slovak Government and the Slovak President launched several activities to increase public awareness on start-ups and innovative companies.<br>(+) The Slovak thematic research priorities the 2016 Presidency of the Council of the European Union in include the single digital market, cybersecurity and start-ups. |
| **4. Insufficient national funding for R&I.** | The R&I policy measures almost completely rely on assistance provided by the Operational Programme Competitiveness and Economic Growth. National innovation spending is 20 times lower than those supported by the OPCEG. | (-) The national funding for R&I remains low.<br>(+) The new tax incentive for R&D activities was introduced in 2015.<br>(+) The third draft of the Action Plan for R&I proposed the introduction of the commitment to increase the R&D state budget expenditure to 0.50% GDP by 2020. |

Source: authors' summary

## References


Balog, M. (2015): Klastrová politika v podmienkach Slovenska {The Cluster Policy in Slovakia}, Bratislava, Slovak Innovation and Energy Agency.

Balog, et al (2015): Automobilový priemysel na Slovensku a globálne hodnotové reťazce {The Automotive Industry in Slovakia and Global Value Chains} Bratislava: The Slovak Innovation and Energy Agency

Beňová, Z. (2015): Meškajúci projekt eHealth otestujú v štyroch nemocniciach {The lagging behind e-Health will be tested in four hospitals}, Pravda Daily, 29 June 2015.

Concept paper for the support of start-ups and the development of the start-up ecosystem in the Slovak Republic
http://www.rokovanie.sk/File.aspx/ViewDocumentHtml/Uznesenie-14906?prefixFile=u

EC, European Commission (2014): Innovation Union Scoreboard 2014, European Commission, Directorate-General for Enterprise and Industry. Available at:

http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm. Accessed in December 2015.

EC, European Commission (2015): Innovation Union Scoreboard 2015. Annex H. Performance per indicator. Accessed in December 2015.

EC, European Commission (2014): Innovation Union progress at country level 2014 Available at: http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=home Accessed in December 2015.

Eurostat (2015): statistics database. Available at:

http://ec.europa.eu/eurostat/data/database. Accessed in July 2015.

Eurostat (2012): She Figures 2012, Gender in Research and Innovation, Statistics and Indicators, Accessed in December 2015.

Erawatch Network (2007): The R&D Specialisation Report for the Slovak Republic. Available at:

http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/reports/countries/sk/report_mig_0003?tab=reports&country=sk Accessed in December 2015.

Erawatch Network (2014): Research inventory for the Slovak Republic. Available at:

http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/sk/country

Accessed in December 2015.

Interview with the Professor Šajgalík (chairman of the Slovak Academy of Science) in the Pravda Daily, 12 January 2015: Šajgalík: Čaká nás najväčšia zmena od roku 1989 {Šajgalík -the SAS is waiting for the biggest change since 1989}.

Kiska, A. (2015): *Kiska v Berlíne: Startupy patria do centra našej pozornosti* {*Kiska in Berlin: Start-ups in the middle of our attention*}

KPMG (2015): EU Funds in Central and Eastern Europe. Progress Report 2007-2014

MESRS, Slovak Ministry of Education, Science, Research and Sports (2014): The 2013 Annual Report on Higher Education. Available at:
https://www.minedu.sk/data/att/6666.zip Accessed in December 2015.

MESRS, Slovak Ministry of Education, Science, Research and Sports (2014): Information on International Co-operation in Science and Technology in 2013 Available at:
https://www.minedu.sk/12769-sk/informacia-o-stave-medzinarodnej-vedecko-technickej-spoluprace-za-rok-2013/ Accessed in December 2015.

MESRS, Slovak Ministry of Education, Science, Research and Sports (2015): *Robert – Jan Smits: „Slovensko má veľký potenciál"* {*Robert – Jan Smith: 'Slovakia has a significant potential'*}, the MESRS press release of 14 July 2015.

MESRS, Slovak Ministry of Education, Science, Research and Sports (2015): Rozpis dotácií zo štátneho rozpočtu verejným vysokým školám na rok 2016 {*The state budget grants for public higher education institutions in 2016*}.

MESRS, Slovak Ministry of Education, Science, Research and Sports (2015): Vysoká škola Goethe Uni Bratislava na Slovensku zaniká {The Goethe Uni HEI closed in Slovakia}.Ministry of Finance of the Slovak Republic (2014): The 2013 State Aid Report, Slovak Government Resolution no. 264/2014 of 4 June 2014.

NAO, National Audit Office (2013): Súhrnná správa o výsledku kontroly financovania vedecko-výskumnej činnosti zo zahraničných zdrojov na vybraných vysokých školách a univerzitách {*Comprehensive report on results of evaluation of financing science and research activities in selected Universities and higher education institution*}. Available at:

http://www.nku.gov.sk/documents/10157/265201/19670--58.pdf Accessed in December 2015.

National Audit Office (2012): Správa o výsledku kontroly čerpania prostriedkov štrukturálnych fondov v rámci operačného programu Výskum a vývoj {*Report on results of audit of expenditure by the Operational Programme Research and Development*}. Accessed in December 2015.

Slovak Research and Development Agency (2014): The 2013 Annual Report. Available at:

http://www.apvv.sk/buxus/docs/agentura/vyrocne-spravy/VS-APVV-2013.pdf Accessed in December 2015.

Slovak Government (2006): Národný strategický referencný rámec Slovenskej republiky na roky 2007 – 2013 – upravené nové znenie (*The National Reference Framework for the Slovak Republic for period 2007-2013 – amended new text*). Slovak Government Resolution No. 457/2006.

Slovak Government, (2007): 'Návrh Inovačnej stratégie SR na roky 2007 až 2013 - upravené nové znenie' {*Proposal for the Slovak Innovation Strategy for period 2004-2013 – amended text*}, in Slovak. Available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=5904

Slovak Government (2007): 'Operačný program Výskum a vývoj' {*Operational Programme Research & Development*}, available at:

http://www.asfeu.sk/operacny-program-vyskum-a-vyvoj/op-vyskum-a-vyvoj/ Accessed in December 2015.

Slovak Government (2007): 'Operačný program konkurencieschopnosť a hospodársky rast' {*Operational Programme Competitiveness and Economic Growth*}, in Slovak. Available at: http://www.opkahr.sk/ Accessed in December 2015.

Slovak Government (2007): The Proposal for the Long-Term Objective of the State S&T Policy up to 2015, Government Resolution No 766/2007 of 12th December 2007' available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=1246 Accessed in December 2015.

Slovak Government (2013): 'The 2012 Annual Report on R&D' available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=23066 Accessed in December 2015.

Slovak Government (2014): 'The 2013 Annual Report on R&D' available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=24034
Accessed in December 2015.

Slovak Government (2015): 'The 2014 Annual Report on R&D' available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=25012
Accessed in December 2015

Slovak Government (2011): Inovačná politika na roky 2011-2013 {*The Innovation Policy for 2011-2014*}. Available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=19611
Accessed in December 2015.

Slovak Government (2011): The Fenix Strategy. Available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=19944
Accessed in December 2015.

Slovak Government (2011): Minerva 2.0 Strategy. Available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=20088
Accessed in December 2015.

Slovak Government (2011): Správa o plnení opatrení Inovačnej stratégie SR a Inovačnej politiky SR za rok 2010 a prvý štvrťrok 2011 {*The 2010 Evaluation Report on implementation of the 2007 Innovation policy*}. Available at:

http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=19850
Accessed in December 2015.

Technopolis group (2012): Trends and Challenges in Public Sector Innovation in Europe Thematic Report 2012 under Specific Contract for the Integration of INNO Policy TrendChart with ERAWATCH (2011-2012), available at

http://ec.europa.eu/enterprise/policies/innovation/files/psi/psi-trend-report_en.pdf
Accessed in December 2015.

Technopolis group (2011): Mini Country Report/Slovak Republic under Specific Contract for the Integration of INNO Policy TrendChart with ERAWATCH (2011-2012), available at

http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/slovakia_en.pdf
Accessed in December 2015.

WEF, World Economic Forum (2015): The Global Competitiveness Report 2014–2015.

## Abbreviations

| | |
|---|---|
| BERD | Business Expenditures for Research and Development |
| CERN | European Organisation for Nuclear Research |
| ERA | European Research Area |
| COST | European Cooperation in Science and Technology |
| ERA-NET | European Research Area Network |
| ESA | European Space Agency |
| ESIF | European Structural and Investment Funds |
| ESFRI | European Strategy Forum on Research Infrastructures |
| FP | European Framework Programme for Research and Technology Development |
| EU | European Union |
| EU-27 | European Union including 27 Member States |
| FDI | Foreign Direct Investments |
| FP | Framework Programme |
| FP7 | 7th Framework Programme |
| GBAORD | Government Budget Appropriations or Outlays on R&D |
| GDP | Gross Domestic Product |
| GERD | Gross Domestic Expenditure on R&D |
| GOVERD | Government Intramural Expenditure on R&D |
| GUF | General University Funds |
| HEI | Higher education institutions |
| HERD | Higher Education Expenditure on R&D |
| HEIs | Higher education institutions |
| HES | Higher education sector |
| IP | Intellectual Property |
| KEGA | KEGA Grant Agency (Grantová agentúra KEGA) |
| NADSME | National Agency for Small and Medium Enterprises (Národná agentúra pre malé a stredné podniky) |
| MESRS | Ministry of Education, Science, Research and Sports (Ministerstvo školstva, vedy, výskumu a športu) |
| MNE | Multinational Enterprise |
| NRIR | National Research Infrastructures Roadmap |
| PRO | Public Research Organisations |
| OECD | Organisation for Economic Co-operation and Development |
| OPCEG | Operational Programme 'Competitiveness and Economic Growth' (Operačný program Konkurencieschopnosť a hospodársky rast) |
| OPE | Operational Programme 'Education' (Operačný program Vzdelávanie) |
| OPRD | Operational Programme 'Research and Development' (Operačný program Výskum a vývoj) |
| OPRI | Operational Programme Research and Innovation Operačný program Výskum a inovácie) |
| R&D | Research and development |

| | |
|---|---|
| R&I | Research and innovation |
| RI | Research Infrastructures |
| RIS3 | Research and Innovation Strategies for Smart Specialisation |
| RNP | Research Networking Programmes |
| RTDI | Research Technological Development and Innovation |
| SAS | Slovak Academy of Sciences (Slovenská akadémia vied) |
| SBA | Slovak Business Agency |
| SF | Structural Funds |
| SIEA | Slovak Innovation and Energy Agency (Slovenská inovačná a energetická agentúra) |
| SME | Small and Medium Sized Enterprise |
| SRGBST | Slovak Republic Government Board Council for Science, Technology and Innovation (Rada vlády SR pre vedu, techniku a inovácie) |
| SRDA | Slovak Research and Development Agency (Agentúra pre výskum a vývoj) |
| SRDP | State Research and Development Programmes (Štátne programy výskumu a vývoja) |
| S&T | Science and technology |
| VEGA | VEGA grant agency (Grantová agentúra VEGA) |
| VC | Venture Capital |

## List of Figures

## List of Tables

## Annex 1 – List of the main research performers

Table: Top 10 R&D performers in Slovakia, by 2015 Scimago research output indicator and amount of institutional R&D funding.

| Rank | Institution | Output | Institutional R&D funding (€m) |
|---|---|---|---|
| 1 | Slovak Academy of Sciences | 3.42 | 58.52 |
| 2 | Comenius University in Bratislava | 2.20 | 32.01 |
| 3 | Slovak University of Technology | 1.56 | 22.58 |
| 4 | Technical University of Kosice | 0.88 | 13.54 |
| 5 | Pavol Jozef Safarik University in Kosice | 0.75 | 10.50 |
| 6 | University of Zilina | 0.47 | 10.54 |
| 7 | Slovak Medical University in Bratislava [(a)] | 0.22 | n.a. |
| 8 | Slovak University of Agriculture in Nitra | 0.20 | 5.86 |
| 9 | Technical University in Zvolen | 0.18 | 3.16 |
| 10 | Constantine the Philosopher University in Nitra | 0.17 | 4.82 |

Sources: Scimago institutional ranking; the 2015 State Budget Law; and MESRS (2015): List of subsidies for public HEIs in 2015. Notes: Output: Total number of documents published in scholarly journals indexed in Scopus. Output indicator values for regional competitors of Slovakia: Czech Republic: Academy of Sciences of the Czech Republic (9.46), Charles University (8.01), Czech Technical University in Prague (2.86). Hungary: Hungarian Academy of Sciences (5.50), Budapest University of Technology and Economics (2.58), Semmelweis University (2.27). Funding figures by the MESRS cover public HEIs only. (a) The Slovak Medical University in Bratislava is a private HEI; all other HEIs in the list are public.

Data on private research funding are quite scarce in Slovakia. No Slovak company has been included in the EU Industrial R&D Investment Scoreboard since 2005. Annual reports of several Slovak companies provide limited data on R&D spending[63]:

- Continental Matador Rubber (automotive parts): €21.452m (2013),
- US Steel: €3.1m (2014);
- Biotika (pharma) €2.456m (2014).
- Slovak Power: €2.0m (2014);
- Slovnaft: (oil processing) €0.488m (2014);
- Zeleziarne Podbrezová (manufacture of metals): €0.360m (2013).

[63] Sources: author's survey of the annual reports by the respective companies.

## Annex 2 – List of the main funding programmes[64]

The Slovak Republic has had no national research programmes since 2010. The Slovak Research and Development Agencies funded various projects under (i) general calls and/or (ii) specialised schemes (bilateral exchange, multilateral co-operation in R&D, etc.). Budgets for particular schemes were not available.

| Name of the funding programme | Timeline | Budget | Target group |
|---|---|---|---|
| Programmes of the SRDA | Annual budgets | €26.16m (2015) | Public and private research bodies, individual researchers. |
| The Operational Programme research and Development | Call-based funding | €1,354.5m (2008-2015) | Public and private research bodies |
| The Operational Programme Competitiveness and Economic Growth | Call-based funding | €447.5m (2008-2015) | Public and private research bodies |
| The Operational Programme Bratislava Region | Call-based funding | €30.2m (2008-2015) | Public and private research bodies |

Source: The 2015 State Budget Law

Notes: Budgets for the Operational Programmes refer to the certified spending by the support measures relevant for R&I, as of 31.12.2015. The abovementioned programmes launched their first calls in 2008.

[64] This list is not exhaustive and does not include the programmes financed from Structural Funds.

## Annex 3 – Evaluations, consultations, foresight exercises

The Slovak Government (2015): The Pilot project– contribution to the EU 2020 targets in research and development

The Ministry of Education, Science, Research and Sports (2015): The 2014 Annual Report on Research and Development

**How to obtain EU publications**

Our publications are available from EU Bookshop (http://bookshop.europa.eu),
where you can place an order with the sales agent of your choice.

The Publications Office has a worldwide network of sales agents.
You can obtain their contact details by sending a fax to (352) 29 29-42758.

LF-NA-27860-EN-N

## JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

*Serving society*
*Stimulating innovation*
*Supporting legislation*


doi:10.2791/751866

ISBN 978-92-79-57795-6